

THE STATE OF THE NATION 2024

The Diabetes
Epidemic in Australia

**UNITE IN THE
FIGHT FOR
CHANGE.**

Contents

| | |
|---|-----------|
| Group Chief Executive Officer Introduction..... | 3 |
| Executive Summary | 4 |
| 1. Key Recommendations | 5 |
| 2. Diabetes defined | 7 |
| 3. How big is the burden? | 10 |
| 4. Impact of the epidemic..... | 14 |
| 5. Which groups are most affected?..... | 26 |
| 6. How is Australia responding? | 33 |
| 7. Looking ahead: further action is crucial..... | 41 |
| 8. Summary | 48 |
| References..... | 49 |

Diabetes Australia acknowledges the Traditional Owners of the lands on which we live and work. We recognise their connection to land, waters and culture. We pay the utmost respect to them, their cultures and to their Elders past and present. We recognise that Australia is made up of hundreds of different Aboriginal and Torres Strait Islander peoples, each with their own culture, language and belief systems. Their relationship with country remains of utmost importance as it is the foundation for culture, family and kinships, song lines and languages.

© Diabetes Australia. This report is copyright. Apart from any use as permitted under the *Copyright Act 1968*, no part may be reproduced without written permission from Diabetes Australia. Requests and enquiries concerning reproduction and rights should be directed to Diabetes Australia, GPO Box 3156 Canberra ACT 2600 or by email to admin@diabetesaustralia.com.au.



Group Chief Executive Officer Introduction

We stand at a critical point in our nation's health landscape.

The pages of this *State of the Nation* report lay bare a sobering reality: Australia is in the grips of a diabetes epidemic.

At the heart of this epidemic are 2 million Australians living with diagnosed and undiagnosed diabetes, and many more at high risk.

The continued high rates of diagnosis, particularly in young people, paint a stark picture of an epidemic that shows no signs of abating.

With each passing year, more Australians are thrust into the challenging reality of living with diabetes, facing heightened risks of severe complications and placing greater strain on our healthcare system and economy. The numbers speak volumes: between 2013 and 2023 the number of Australians living with diabetes increased by 32%. And behind these numbers are of course real people who are living with diabetes, and living with the very real concern for their health, the risk of complications and their future quality of life.

The urgency of the situation cannot be overstated. Enhanced prevention strategies, improved access to healthcare, and targeted investments in research are imperative to stem the tide of this epidemic.

We must act decisively, innovatively, and collectively to confront this challenge head-on.

The *State of the Nation* is an urgent call to stem the tide of diabetes in Australia. It presents comprehensive information about which Australians are most at risk, the severity of diabetes complications for individuals as well as the health system and economy, and demonstrates urgent action that needs to be taken on a national level.

This report is both a clarion call and a roadmap for action. It outlines priority recommendations to combat the epidemic. We need innovative solutions that will drive meaningful change if we are serious about improving the lives of people living with diabetes, and those at risk.

The time for bold, decisive action is now.

Together, we can rise to meet this challenge and build a healthier, more resilient Australia.

Justine Cain

Group CEO, Diabetes Australia



Executive Summary

Diabetes in Australia has reached a crisis point. As this *State of the Nation* report reveals, an unrelenting diabetes epidemic is unfolding nationally, with alarming rates of diagnosis in young people.

More people being diagnosed with diabetes earlier ultimately means more Australians living longer with the condition, and at greater risk of developing severe complications. This trend is placing an unprecedented burden on individuals, the healthcare system, and the Australian economy.

Over the past decade, the number of people diagnosed with diabetes between the ages of 21 – 39 has increased by 44%, while diagnoses before the age of 20 have risen by 17%.

Despite a tripling in the number of Australians living with diabetes, there is still no national diabetes prevention plan.

At the same time, Australia's population is ageing. By 2050, nearly a quarter of Australians will be over 65, and the number of those over 85 will double. This demographic shift, coupled with rising diabetes rates, foreshadows a significant increase in the number of older Australians living with diabetes, and diabetes complications.

More than 300 people are diagnosed every day and an estimated 2 million Australians now live with diabetes.

From 2013 to 2023, the total number of people known to be living with all types of diabetes in Australia rose by 32%.

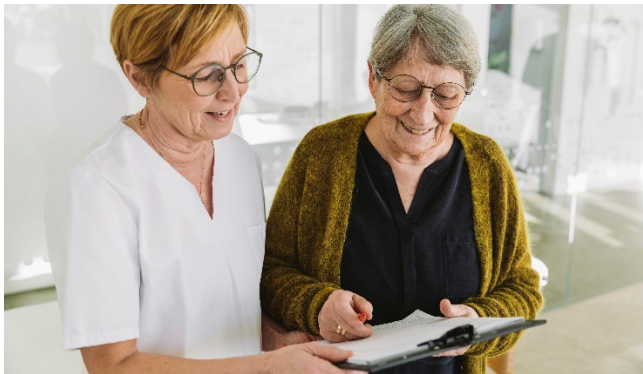
There is an urgent need to do more to prevent and promote remission of type 2 diabetes and to prevent the associated complications of diabetes, to expand access to technologies, improve access to the diabetes health workforce, and to ensure a more targeted investment in diabetes research to ultimately find a cure.

Diabetes has become one of the largest and most complex health challenges Australia has ever faced. This report reveals concerning trends affecting vulnerable communities nationally which, without strong, considered, targeted action, show no signs of slowing.

Bold, innovative investments are needed to help Australia stem the tide of the diabetes epidemic. This report outlines priority recommendations to address the diabetes epidemic and underscores the opportunities for innovative solutions.

This crisis point is a call for more to be done to address the diabetes epidemic in Australia. The future of our nation's health depends on it.

1. Key Recommendations



Prevention & Screening

1. Introduce a 20% health levy on sugar-sweetened beverages and reinvest the revenue in public education campaigns and initiatives to prevent chronic disease and address childhood obesity.
2. Mandate a Health Star Rating System for all packaged foods.
3. Implement a national type 2 diabetes high-risk prevention program that drives awareness of risk factors for type 2 diabetes and other chronic diseases, and supports people to take action through lifestyle modification.
4. Increase opportunistic type 2 diabetes screening by funding Primary Health Networks to conduct screening programs tailored to local communities; and ensure culturally appropriate screening in Aboriginal and Torres Strait Islander communities.
5. Provide MBS funding for access to allied health professionals for people living with prediabetes, as a type 2 diabetes prevention measure.
6. Establish a national Diabetes Kidney Disease screening program in order to reduce the high rates of diabetes-related kidney disease in Australia.
7. Incentivise and support screening for prevention-focused general practice through MBS rebates.
8. Develop a national type 2 diabetes prevention phone line.

Care & Treatment

9. Promote type 2 diabetes remission by supporting community-based programs that provide options for individuals, based on personal circumstances.
10. Develop a strategic plan to grow the diabetes health workforce.
11. Increase MBS funding for Credentialed Diabetes Educator visits for those at increased risk of diabetes-related complications, in order to prevent hospitalisations.
12. Expand subsidies for diabetes technologies to ensure affordability based on clinical need rather than 'type' of diabetes.
13. Increase the supply of GLP-1 receptor agonist medicines in the market and improve regulatory measures (including approval processes for new technology) to strengthen the supply chain.



14. Ensure all Australians living with diabetes who experience mental health challenges can access support from mental health professionals with appropriate diabetes training.
15. Enhance and optimise the NDSS database to enable it to better provide recall and reminder notices to people living with diabetes to increase rates of preventive diabetes health checks.
16. Invest in the development of integrated models of care that support a multidisciplinary diabetes care team, involving general practice, Credentialed Diabetes Educators, other allied health professionals and endocrinologists.

Vulnerable communities

17. Deliver a new National Diabetes in Aged Care training program for aged care staff to ensure all people living with diabetes receive essential diabetes-specific healthcare.
18. Introduce an MBS funded Gestational Diabetes Management Plan to provide subsidised access to allied health professionals including Credentialed Diabetes Educators and Accredited Practising Dietitians.

19. Ensure all Aboriginal and Torres Strait Islander families can access culturally appropriate type 2 diabetes prevention programs.
20. Implement workforce strategies to ensure Aboriginal and Torres Strait Islander people with diabetes have access to multidisciplinary services at all stages of life.
21. Improve training for disability support workers supporting people living with disability and diabetes.
22. Ensure culturally appropriate prevention programs and workforce training in CALD communities.

Research & National Implementation

23. Urgently increase funding for diabetes research through the National Health & Medical Research Council.
24. Establish a Diabetes and Obesity Mission in the Medical Research Future Fund, in order to ensure a funding pipeline for critical diabetes research.
25. Release a funded Implementation Plan for the Australian National Diabetes Strategy 2021-2030 including support for better integration and coordination of diabetes care.



2. Diabetes defined

Diabetes Mellitus (often just called diabetes) is a metabolic condition characterised by high blood glucose levels which may arise from either the body's inability to produce insulin or its inability to respond to insulin. Insulin is a hormone that regulates blood glucose levels by allowing the body's cells to absorb and use glucose for energy. If hyperglycaemia is not treated it can become severe and cause serious health problems. There are distinct types of diabetes with different causes; the three most common types of diabetes are type 1 diabetes, type 2 diabetes and gestational diabetes mellitus (GDM). There are also other, rarer, types of diabetes that can be caused by genetic variations, other medical conditions (also known as secondary diabetes) or by certain medications (such as corticosteroids, antipsychotics, and beta-blockers).

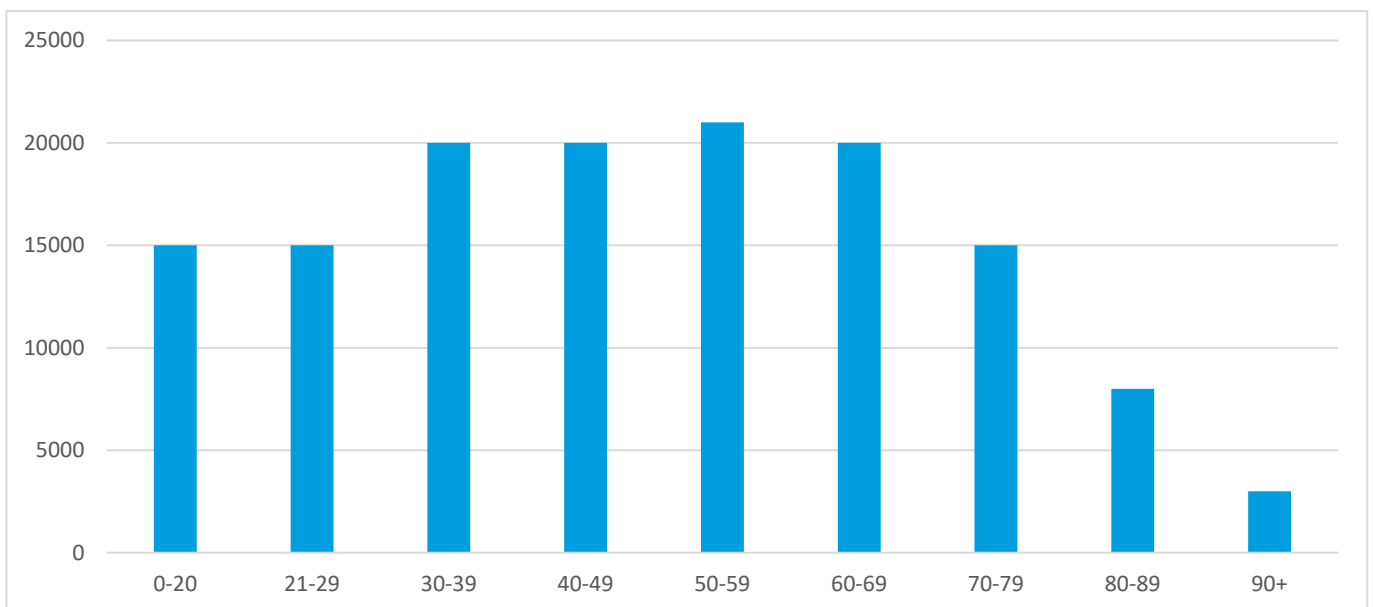
2.1 Type 1 diabetes

Type 1 diabetes is a chronic, autoimmune condition. The exact cause of this type of diabetes is not fully understood, but it is believed to result from an autoimmune response in which the body's immune system mistakenly attacks and destroys the insulin-producing beta cells in the pancreas. Type 1 diabetes currently cannot be prevented, and it is not linked to modifiable lifestyle factors. More research on the exact genetic and environmental causal factors of type 1 diabetes is needed.

Type 1 diabetes can develop very quickly, and if it is not diagnosed in time, it can be fatal.

However, while the peak age of diagnosis for type 1 diabetes is between 10 - 14 years, significant numbers of new type 1 diabetes diagnoses are occurring in adults, including those 65 years and over, and particularly in men [1].

Australians with type 1 diabetes by age group





2.2 Type 2 diabetes

Type 2 diabetes is a condition in which the body doesn't effectively use the insulin that it produces, often resulting in high blood glucose levels. The body produces more insulin to compensate and eventually the body's cells become resistant to insulin. The condition has strong genetic and family-related (non-modifiable) risk factors and is also often associated with modifiable lifestyle risk factors. We do not know the exact genetic causes of type 2 diabetes. People may be able to significantly slow or even halt the progression of the condition through changes to diet and increasing the amount of physical activity they do. Evidence shows that around half of all people with recently diagnosed type 2 diabetes can achieve remission through intensive dietary changes and weight loss.

There are a range of genetic and other risk factors for developing type 2 diabetes. These include, but are not limited to, being overweight, unhealthy diet (with a possible link with eating processed foods and developing type 2 diabetes), physical inactivity, smoking, high blood pressure, high blood lipids, and a family history of diabetes [2]. Women who have had a previous gestational diabetes

mellitus (GDM) diagnosis are seven times more likely to develop type 2 diabetes later in life. Children born to mothers with GDM are also at higher risk of developing type 2 diabetes later in life.

Health inequalities, demographic, socio-economic, and environmental factors are also important contributors towards the number of people at risk of developing, and living with, diabetes in Australia.

Obesity is the main risk factor for developing type 2 diabetes, although not everyone who is overweight or obese will develop diabetes [3–6]. Australia has an obesogenic environment that promotes obesity with accessible unhealthy food choices and sedentary lifestyles.

Recent research has also suggested that type 2 diabetes may be more complex than previously thought, with one study identifying at least four subtypes [7]. The levels of insulin resistance, risk and severity of complications differed across these subtypes, meaning that some people living with type 2 diabetes may be at higher risk of diabetes-related complications than other groups. Further research is needed to validate and understand these findings.

2.3 Gestational diabetes

Gestational diabetes (GDM) typically develops during the second or third trimester of pregnancy. While the exact causes are not fully understood, there are some known risk factors that can increase a woman's likelihood of having GDM. Some of the most common risk factors include: age (women over 35 have a higher risk of GDM); family history; prior GDM; being overweight or obese before becoming pregnant; gaining excessive weight during pregnancy; ethnicity; and having polycystic ovarian syndrome [8]. Having one or more of these risk factors does not mean that a woman will develop GDM. However, if they do, GDM can cause pregnancy complications [9].

Furthermore, women with a history of GDM have a high risk of developing type 2 diabetes later in life [10] as well as cardiovascular disease [11].

2.4 Other types of diabetes

There are a number of other, less common types of diabetes that are generally grouped together under the term "other types of diabetes". These include maturity onset diabetes of the young (MODY), latent autoimmune diabetes in adults (LADA), type 3c diabetes (which occurs when another disease, such as pancreatitis damages the pancreas), people who have had their pancreas removed surgically, or cystic fibrosis-related diabetes.



3. How big is the burden?

In the absence of a national plan for type 2 diabetes prevention, the number of people living with diabetes in Australia continues to rise. Based on data from the National Diabetes Services Scheme (NDSS) from 2013 to 2023, the total number of people known to be living with all types of diabetes in Australia rose by **32%**; from approximately 1.1 million to close to 1.5 million people [12]. The number of people living with type 2 diabetes tripled in Australia between 1990 and 2019 [13].

As of March 2024, there were **1,468,142** people with diabetes registered with the NDSS in Australia [12]. Type 2 diabetes makes up the majority of registrations, with type 1 diabetes representing 1 in 10 of all registered diabetes cases (see table 1).

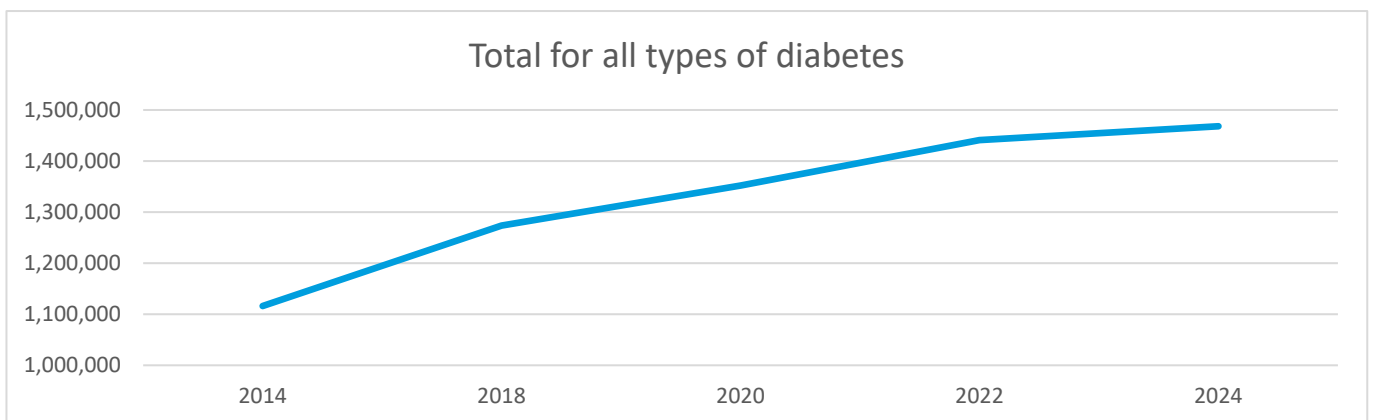
GDM is the fastest growing type of diabetes in Australia, with the number of women diagnosed annually more than doubling over the past decade.

Table 1. Australian NDSS registrations by diabetes type, as at 31 March 2024.

| Diabetes type | Number | % | Registered in past year |
|----------------------|------------------|------------|-------------------------|
| Type 2 diabetes | 1,273,248 | 85.7 | 65,209 |
| Gestational diabetes | 45,015 | 3.1 | 44,902 |
| Type 1 diabetes | 137,748 | 9.4 | 3,820 |
| Other diabetes | 12,131 | 0.8 | 1,255 |
| Total | 1,468,142 | 100 | 115,186 |

Data source: NDSS Diabetes Snapshot, March 2024.

*An additional 188,698 women who previously had GDM are registered with the NDSS on the National Gestational Diabetes Register.



While NDSS data provide a reasonable estimate of the number of people currently living with diabetes in Australia, they are likely to underestimate the true number. The NDSS data only represent people who have been formally diagnosed with diabetes and who have also registered with the NDSS. It is estimated that approximately 500,000 more people may be living with undiagnosed type 2 diabetes in Australia [14]. The total number of people living with diabetes could therefore be up to 2 million individuals (or 7.5% of the total population).

The data presented above do not account for Australians who are living with intermediate hyperglycaemia (commonly referred to as type 2 'pre-diabetes'). Type 2 pre-diabetes refers to elevated blood glucose levels above normal ranges, but which do not meet the diagnostic criteria for diabetes. This is an important target group who might be amenable for early interventions to reduce their risk of developing diabetes. It is estimated that 1 in 6 adult Australians over the age of 25, or approximately 2 million people, are living with pre-diabetes and are at high risk of developing type 2 diabetes [15]. Every year 5-10% of people living with pre-diabetes develop type 2 diabetes [16]. While not everyone with pre-diabetes will develop type 2 diabetes, it is a useful term to convey diabetes risk to the general community and to identify people at high risk of developing type 2 diabetes.

The number of people living with diagnosed diabetes is expected to continue to rise significantly in coming years. If current trends continue, there could be up to 3.6 million people living with diagnosed diabetes in Australia by 2050 [17]. That is 2.5 times the current number. That projection relates only to diagnosed diabetes and does not include

people who will be at risk of diabetes, with pre-diabetes or undiagnosed, so the true number could be up to 4 million by 2050.

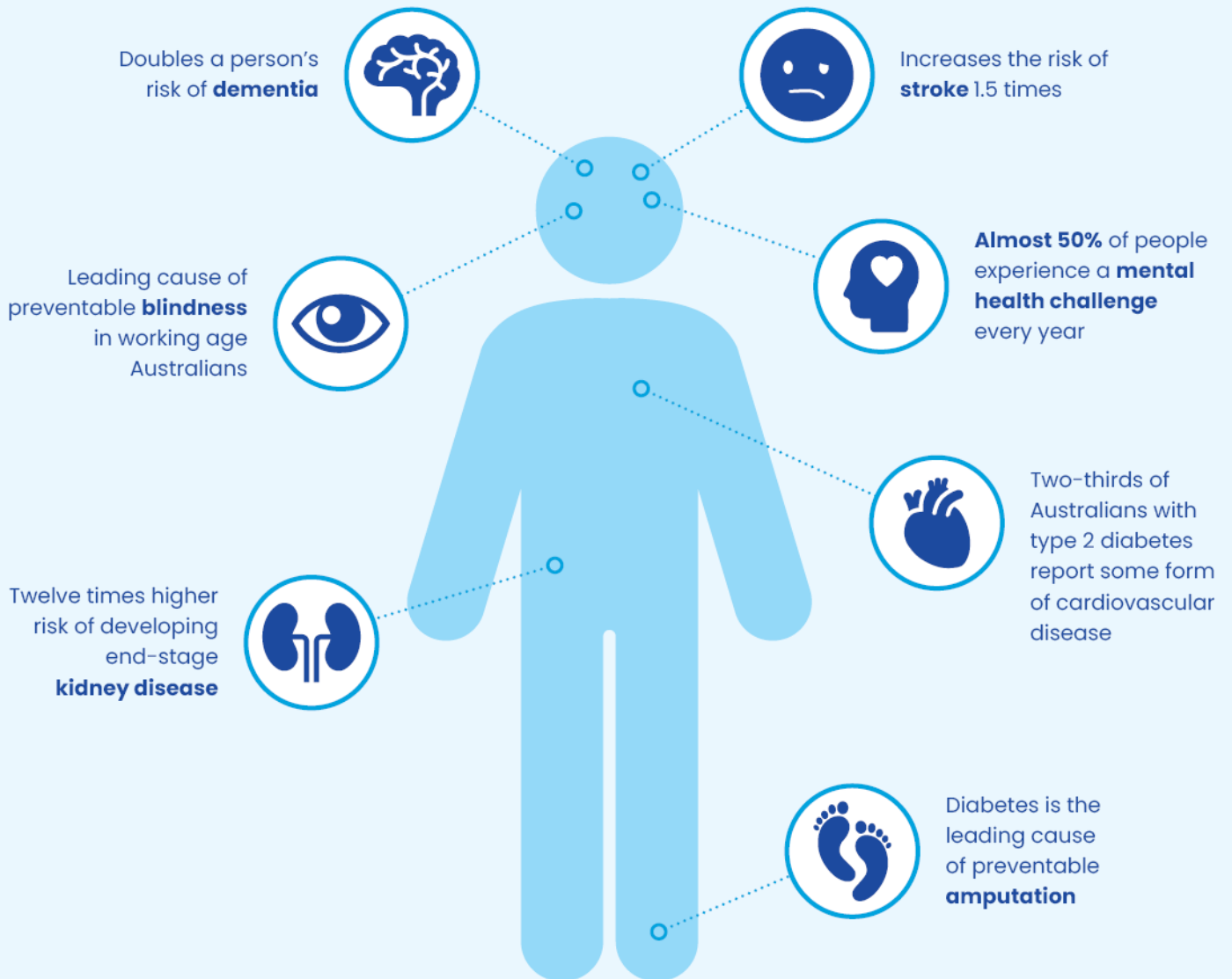
CASE STUDY

Type 1 diabetes diagnosis



Vicky Kavalas was 14 months old when she caught the flu. Her parents knew she was in trouble about a week after Vicky first became ill, and she was admitted to ICU for four days where she was diagnosed with type 1 diabetes. Vicky's Mum did everything she could to make sure her toddler had the best care, and her dad worked two jobs to cover the extra medical expenses. "It wasn't easy for them as even family judged us. They thought my parents were too attentive to my blood glucose monitoring, too rigid with my eating and the timing of my meals," Vicky said. "No one really understands what's involved when a child is diagnosed with type 1, or how important it is to keep track of the condition." Now 24, Vicky has experienced the challenges of living with diabetes and knows how important technology is for day-to-day diabetes management.

DIABETES IMPACTS EVERY PART OF THE BODY



Pregnancy – Twice as likely to require **caesarean birth** (women living with type 1 and type 2 diabetes)



Children born to mothers with type 2 diabetes and gestational diabetes are at higher risk of developing type 2 diabetes

4. Impact of the epidemic

The impacts of diabetes are broadly divided into three categories: impact on people living with diabetes, impact on the health system, and economic impacts (direct and indirect).

4.1 Impact on people living with diabetes

Diabetes is a complex condition that requires ongoing monitoring every day. Living with diabetes can have physical, mental, social and financial impacts on a person.

4.1.1 Complications of diabetes

Effective diabetes management is crucial to reduce the risk of complications. Diabetes can affect all systems in the body. However, the complications are often misunderstood and may therefore not be attributed to diabetes. As a result, the severity of this condition is often underestimated. Serious complications include:

Hypoglycaemia: Occurs when blood glucose levels fall below the normal range. If not treated quickly, it can progress to loss of consciousness and, in very rare circumstances, death.

Diabetic ketoacidosis: Also known as DKA, this is caused by a severe lack of insulin in the body. It is a serious condition which mostly affects people with type 1 diabetes. If left untreated it can be life threatening.

Kidney disease: Diabetes is the leading cause of end stage kidney disease. An estimated 330,000 Australians living with diabetes have chronic kidney disease. Around 10,000 of those will experience kidney failure and require dialysis or a kidney transplant [19].

Dementia: Diabetes is a significant risk factor for dementia and almost doubles dementia risk compared to those with normal glucose tolerance [20]. There are 3,980 annual dementia cases amongst people living with diabetes [21].

Stroke: People living with diabetes have a 1.5 - 2 times increased risk of stroke compared to people without diabetes [22].

Amputations: Diabetes is the leading cause of non-traumatic lower limb amputations [23].

Vision loss and blindness: Diabetic retinopathy is the leading cause of preventable blindness in working-age adults [24].

Mental and emotional impact: 50% of people living with diabetes report experiencing a mental health challenge [25].

Cardiovascular disease: 40% of Australians living with type 2 diabetes also have cardiovascular disease [26].

Cancers: Diabetes is associated with an increased risk of certain cancers. Both type 1 and type 2 diabetes are associated with an increased risk of incidence and mortality for overall and site-specific cancers [27,28].

Liver disease fibrosis: Type 2 diabetes is a major driver of non-alcoholic fatty liver disease and associated complications such as cirrhosis and hepatocellular carcinoma [29,30].

Pregnancy complications: Those with pre-existing type 1 and type 2 diabetes have up to 9-fold risk of babies with congenital malformations such as congenital heart disease and spinal malformations [128].

Dental disease: There is a high prevalence of periodontal disease in adults with type 2 diabetes [129].

It is still unclear what exactly causes complications and why some people develop them more seriously than others. More accurate ways of assessing diabetes complications and their deterioration over time are needed. For example, the current methods of measuring kidney disease are only accurate when there has been over a 50% loss in kidney function. This is particularly notable with a lack of research into the kidney complications in type 1 diabetes [31]. Being able to recognise the signs and symptoms of developing and progressing complications would enable proactive preventative treatment, thereby improving the quality-of-life and saving the lives of many people living with diabetes.

Risk of infection

It is also notable that multiple relationships exist between diabetes and infection, yet remain poorly understood [32,33]. People living with diabetes are at increased risk of infection after surgery. They also have higher complications from certain common bacterial infections such as cellulitis, urinary tract infection, pneumonia, and systemic fungal infection [34].

Vaccination in most people with diabetes, against influenza and streptococcal pneumonia, are routinely recommended [35,36]. Some data suggest that greater hyperglycaemia increases infection risk and complications of infection [37], and improved glycaemia, including in an inpatient hospital setting may lead to improved outcomes in those with diabetes and infection [38].

4.1.2 Access to services, technologies and medicines

Inequitable access to diabetes health services, technologies and medicines has a significant impact on Australians living with diabetes. And this inequity is increasing.

People living in rural and remote Australia have difficulty accessing healthcare professionals, such as GPs. However, access issues extend beyond this, with noted difficulties in accessing diabetes support services not just in the regions, but also in some metropolitan areas [39,40]. This access issue can be demonstrated by considering the total number of people living with diabetes in Australia (approximately 1.4 million) contrasted with the number of Credentialed Diabetes Educators (CDEs; around 1,600), GPs (around 40,000) and tertiary endocrinologists (around 1000); the majority of these professionals are based in urban Australia [41,42].

There are also specific pockets of poor access to health care and services that negatively impact some communities. For instance, while complications associated with kidney disease are one of the leading causes of cardiovascular disease, heart failure and strokes [43] access to life-saving dialysis services can be challenging, especially for Aboriginal and Torres Strait Islander people and those living in remote areas [44,45].

More broadly, the impact of limited access to care is that most Australians living with diabetes are not getting regular health checks including [46]:

- 50% not getting HbA1c checks
- 29% not getting their blood pressure checked
- 51% not getting their cholesterol checked
- 73% not getting their kidneys checked
- 41% not getting their weight checked

The National Association of Diabetes Centres provides a broad collaborative to improve standards of care for people with diabetes [47]. Multidisciplinary services provided by the Centres commonly include type 1 diabetes, diabetes in pregnancy, paediatric diabetes,

and complications of diabetes, including foot care services for people with foot ulceration or other complex foot conditions [48] [49]. Specialist Diabetes Centres can also act as a key interface between inpatient diabetes care and primary care.

Compounding this are issues in accessing the latest medicines and technologies to help manage diabetes. This is the case for people living in rural and remote Australia, but also for people in all areas who are experiencing out-of-pocket costs when paying for products.

Access issues also extend to medicines. In particular, a new class of treatment called glucagon-like peptide -1 receptor agonists (GLP-1A's) which are effective in lowering blood glucose levels. Despite these drugs (such as Ozempic) being recommended for use, according to the Therapeutic Goods Administration (TGA) there has been an ongoing global shortage since 2022 and the pharmaceutical company that supplies Ozempic has advised that supply throughout 2024 will remain limited [51].

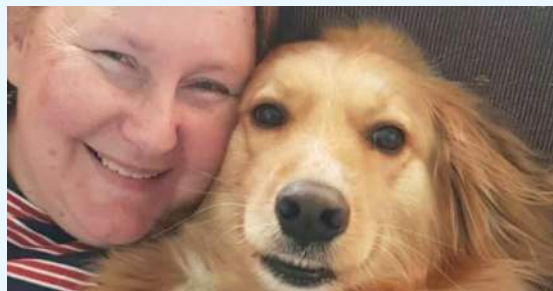
The TGA notes that the demand for Ozempic for other conditions (such as weight loss) has increased substantially and it is not known when the medicine will be available in sufficient quantities to meet the demand in Australia. For people living with diabetes, the impact of this global shortage has been significant.

For parts of 2022 and 2023, people living with diabetes were also impacted by shortages of Ryzodeg (insulin) and the GlucaGen HypoKit.

Shortages of diabetes medicines and products interrupt diabetes self-management and adds to the growing mental health challenges associated with living with diabetes.

CASE STUDY

Lived experience: Ozempic shortages



Like many Australians with type 2 diabetes, **Yvonne Appleby** has experienced both the life-changing impact of Ozempic and the anxiety of not being able to access the medication.

Despite regularly taking Metformin and living a healthy lifestyle since her diagnosis in 2011, it wasn't until Yvonne started Ozempic in August 2021 that she started to feel well again.

"I lost weight and my doctor said it was the healthiest I'd ever been."

By December 2021, Yvonne could not buy the medication due to the global supply shortage.

"It made me so angry hearing about the shortage of this 'Miracle Weight Loss Drug' in most news bulletins," she said. "It wasn't a weight loss drug. It was life-changing medication for people living with diabetes, and we couldn't access it."

While supply has improved somewhat, Yvonne has not been able to overcome ongoing anxiety that her Ozempic supply will dry up again.

Equity in Technology Access

As technology continues to evolve, access to new devices is becoming increasingly important. In 2022 the diabetes community was successful in securing Federal Government funding to subsidise continuous glucose monitoring (CGM) devices for people living with type 1 diabetes. While that has been a successful outcome, cost continues to be a major factor preventing people with type 2 diabetes and other types of diabetes from accessing the technology. The cost can be up to \$5,000 per device per year [50] and without a subsidy, that amount is unaffordable for many Australians living with diabetes. Subsidies for CGM devices could range from very restricted priority population use (for example women with type 2 diabetes who are pregnant), to intermittent use for all people living with diagnosed diabetes.

In addition, despite having access to subsidised CGM devices, adults living with type 1 diabetes do not have access to subsidised insulin pumps. When used together, these form Automated Insulin Delivery (AID) systems which are a life changing technology for a person regularly injecting insulin. Subsidised access to both CGM and AID devices would improve the day-to-day management of diabetes, increasing time in range and reducing the risk of complications. This reduces the burden of disease and the cost to the health system in the long term.



4.1.3 Mental health

Almost 50% of people living with diabetes experience a mental health challenge every year [25].

There is a complex bi-directional relationship between diabetes and some mental health conditions. While more research is needed to fully understand the intricacies of this association, research suggests that living with mental health conditions may put people at increased risk of developing type 2 diabetes [52]. Furthermore, the use of particular antipsychotics (and some antidepressants) has been linked with causing or worsening diabetes [53]. Living with the symptoms of mental health conditions can also in turn make managing all types of diabetes more challenging and so may result in an increased risk of serious complications and hospitalisations. A recent study showed that a significant number of hospital admissions for psychiatric disorders occurred among Australians with diabetes. The authors reported that hospitalisation rates for depressive disorders were substantially higher in people living with diabetes when compared to the general Australian population [54].

While further research is needed to understand how diabetes may affect mental health, it is possible that alterations in the brain chemistry, such as damage from diabetic neuropathy or blocked blood vessels in the brain, may contribute to mental health conditions such as depression and other

neurological and degenerative brain conditions. For example, people living with type 2 diabetes have almost double the risk of developing dementia compared to people who have not been diagnosed with diabetes [20]. These kinds of conditions can compound the challenges of self-managing diabetes and preventing serious complications from occurring. Furthermore, it is possible that these changes in the brain may increase the risk and severity of any subsequent diabetes-associated complications.

Access to specialised diabetes mental health care can be difficult to secure, with about 400,000 Australians living with diabetes reporting difficulties in accessing care [25]. Barriers to access span cost (including the limited number of subsidised visits available under a mental health care plan), limited availability of trained healthcare professionals and a lack of mental healthcare professionals with specific training and expertise in diabetes-related mental healthcare.

Primary care

While diabetes mental health challenges are widespread, they are rarely discussed as part of routine diabetes care and are sometimes referred to as a silent diabetes complication. The *Australian National Diabetes Strategy 2021-2030* identifies the provision of mental health care as a necessary area for action, including a mental health assessment upon diagnosis, as well as consideration of its inclusion as part of the Annual Cycle of Care. This is important.

Mental and emotional health challenges can make it more difficult for people living with diabetes to manage the condition. Conversely, appropriate mental health support has been shown to greatly improve diabetes management, reduce the risk of diabetes-

related complications and, consequently, lower the cost of healthcare.

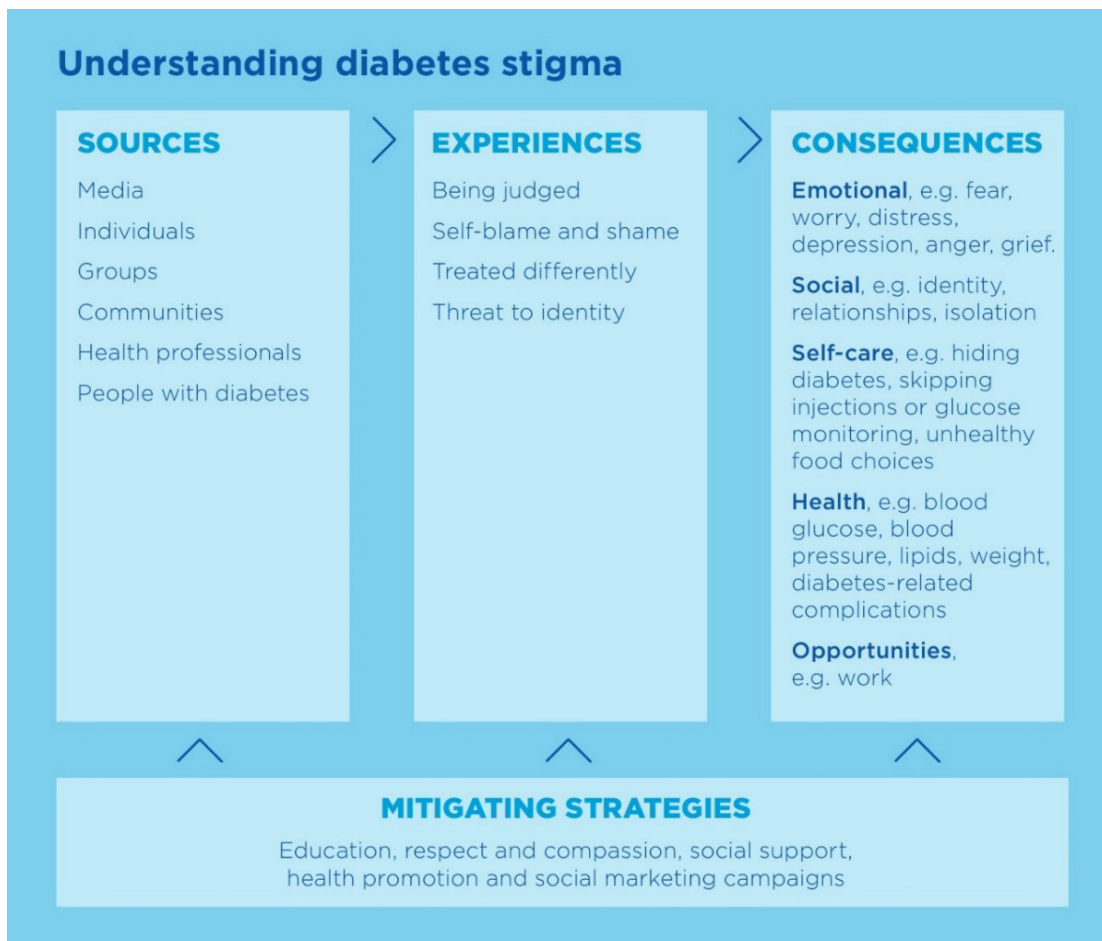
4.1.4 Stigma around diabetes

People living with diabetes often report experiencing diabetes stigma. In the ‘Heads Up’ report [55], around 80% of people living with diabetes said that they’ve either been blamed or shamed for having the condition. The stigma associated with diabetes is often driven by misinformation. Some people report being blamed for developing type 2 diabetes through poor lifestyle choices, while others experience stigma associated with having to inject medications and being referred to as a “drug-user”.

Furthermore, 35% of people were found to have felt ‘blamed’ by healthcare professionals

for developing diabetes or not managing their condition well enough if they experienced complications [55].

People with diabetes can feel depressed, frustrated and even ‘burnt out’ by the constant need to manage their condition. According to the survey, just over 70% of people living with diabetes felt that they were empowered to self-manage their condition. However, almost half of survey respondents found that managing their blood glucose levels through having to closely monitor diet, exercise and medication was a constant challenge. While more research needed around the lived experience of people with diabetes and the stigma surrounding it, we know that stigma has multiple, serious, consequences.



Language matters

The words used to talk about diabetes also affect the physical and emotional health of people living with diabetes. They also affect how people in society view people living with diabetes, or those at risk. There has been some positive change to the words and language used about diabetes in recent years but there is still room for improvement.

People living with diabetes and their families deserve communications that are accurate, respectful, inclusive, and free from judgement and bias.



4.2 Impact on the health system

As diabetes is a complex and challenging condition, inevitably there is a considerable burden on the health system. The Australian Institute of Health and Welfare (AIHW) provides a breakdown of how diabetes affects the healthcare system financially [1].

Diabetes costs the healthcare system an estimated \$3.4 billion every year [1].

In 2020-21, expenditure on the Pharmaceutical Benefits Scheme (PBS) to cover the cost of medications was \$952.7 million. Public hospital outpatient care accounted for another \$376.7 million, and the cost for admitted patients in public hospitals was \$752.2 million. GP services constitute an additional expense of around \$290 million.

Notably, the financial burden of treating diabetes tends to grow as individuals age. Over 63% of these healthcare costs are associated with people aged 55 and above [1]. Given Australia's aging population, it is reasonable to expect these expenses to surge considerably in the coming years, further straining the healthcare system and the broader economy.

Complications arising from diabetes represent some of the condition's most physically debilitating and financially burdensome consequences. It was estimated that in 2021-22 over 1.2 million hospitalisations were attributed to diabetes (accounting for 10% of total hospitalisations in Australia). In 2020-21 that included 19,000 emergency department presentations [1].

While these numbers demonstrate a significant burden on the hospital system, they are also likely to be underestimated given the occurrence of medical coding issues that might misattribute the reason for hospitalisation or death [56–58].

4.3 Economic impacts

Diabetes presents a substantial economic burden in Australia, both in direct medical costs and indirect costs resulting from lost productivity, disability, and premature death. These economic impacts are felt at a societal level and at an individual level.

4.3.1 Costs to the national economy

Table 2: Type of costs associated with diabetes.

| Direct Medical Costs | |
|--|---|
| Hospital admissions | People with diabetes often require hospitalization due to the disease itself or its complications, such as cardiovascular events, kidney disease, or foot ulcers. |
| Pharmaceutical products | Costs include medications to manage blood glucose levels, hypertension, and other associated conditions. Additionally, other diabetes supplies such as test strips, insulin, and insulin delivery devices can be expensive. |
| Outpatient care | Regular visits to general practitioners, endocrinologists, credentialed diabetes educators, dietitians, and other specialists contribute to the direct costs. |
| Complications | Management and treatment of complications like retinopathy, nephropathy, neuropathy, foot disease, and cardiovascular disease also accrue substantial costs. |
| Indirect Costs | |
| Reduced productivity | People living with diabetes might experience reduced workplace productivity due to illness, medical appointments, and hospitalisations. |
| Injury from loss of consciousness | Injuries can be sustained during loss of consciousness as a result of hypoglycaemia. |
| Disability | Long-term complications of diabetes can lead to disabilities, further reducing an individual's capacity to work or requiring them to retire early. |
| Informal care | Family members or friends may need to provide unpaid care to those with advanced diabetes or severe complications. |
| Premature death | Diabetes and its complications can lead to premature mortality, resulting in a loss of potentially productive years. |

According to the latest estimates from Diabetes Australia, the annual financial toll of the disease is a staggering \$17.6 billion [59]. A 2014 report by Deloitte Access Economics quantified the loss in productivity due to diabetes at approximately \$5.63 billion per year [60]. Furthermore, a 2018 study found that diabetes significantly reduced the number of productive years lived in the Australian population, representing up to \$80 billion in lost GDP value [61].

The most recent analysis of the economic impact of type 1 diabetes was conducted by JDRF Australia. This study reveals that the annual cost of type 1 diabetes to the Australian economy is approximately \$2.9 billion [62]. Almost one-fifth of these costs are directly borne by the Australian Government. One of the key factors driving this financial burden is the cost associated with treating complications related to diabetes. For an individual living with type 1 diabetes but without any associated complications, the lifetime cost amounts to \$143,000. However, this cost soars up to \$738,000 when complications arise.

The data presents a clear economic case for ensuring that individuals with type 1 diabetes have unhindered access to essential treatments and cutting-edge technologies. These include insulin pumps and glucose monitoring systems that are instrumental in mitigating the risk of developing complications. According to the research from JDRF Australia, supplying all Australians diagnosed with type 1 diabetes with lifelong access to such diabetes management technology would entail a cost of around \$120,000 per individual. However, this investment would yield approximately \$174,000 in lifetime savings due to the reduced incidence and severity of diabetes-

related complications. This translates to a net savings of \$54,000 per person and a benefit-cost ratio of 1.5 [62].

Complications impose a significant financial strain on healthcare systems. Research data indicates that the direct economic costs associated with caring for an individual living with diabetes-related complications have soared to approximately \$9,600 per year, more than doubling the \$3,500 typically required for managing the condition in the absence of such complications [59].

In relation to type 2 diabetes, given the latest economic modelling is more than ten years old, there is a gap in understanding the current economic impact in 2024 which should be prioritised. In order to truly understand the cost of living with type 2 diabetes, contemporary modelling is required.

4.3.2 Costs to people living with diabetes

There are various potential out-of-pocket costs for people living with diabetes. The actual costs to individuals can vary based on the type of diabetes they have, the treatment and management plans for the diabetes, the healthcare providers that they see and whether or not they have private health insurance.

The NDSS provides subsidised access to the following products for the management of diabetes: syringes and needles, blood glucose test strips, urine test strips, insulin pump consumables (eligible people only), CGM products (eligible people only), and support services.

The Medicare Benefits Schedule (MBS) and the PBS are the two other main ways in which technologies and drugs can be subsidised so that costs to people are reduced. However, there may still be out-of-pocket

costs based on how much providers charge for technologies and tests (with the MBS reimbursing a set amount per item) and pharmacy dispensing costs.

There is a PBS Safety Net Threshold which means that if a person has paid over \$1,563.50 a year, then costs are heavily reduced for the remainder of the year. Concession card holders (such as pensioners, people on a low income, and foster carers) pay \$262.80. However, if technologies or medications are not listed on the MBS or PBS, then individuals pay for these privately. This is often the case for new technologies or medicines that are not yet approved for reimbursement and can create substantial inequities of access.

There are also charges to see healthcare providers. The MBS is the main way that visits are subsidised through a 'Medicare rebate'. However, the amount that GPs and specialists actually charge can vary, and unless services are "bulk billed" then there will be an additional charge for people to pay. This also applies for consults with CDEs. Financial support for these is provided through Enhanced Primary Care plans (EPC), which are limited in number. People may therefore end up paying for CDE services out of pocket (up to \$200) if no longer covered by EPCs. Further education programs and self-management courses can be beneficial for people living with diabetes but may also have to be funded privately.

When people experience hospitalisation and complications, the out-of-pocket treatment costs can also vary substantially.

The National Disability Insurance Scheme (NDIS) is another financial support option for people with diabetes; but only for people who have a permanent disability (such as an

amputation or blindness) that has been caused by their diabetes. Some support may also be available for people with another disability that means they are unable to manage their diabetes themselves.

The Closing the Gap – PBS Co-payment program also improves access to affordable PBS medications for eligible Aboriginal and Torres Strait Islander people living with, or at risk of, chronic disease.

Compounded with the costs that people with diabetes may face is the impact on lost productivity and personal income that diabetes can cause [63]. People living with diabetes may need to take time off work to attend medical appointments. This might also affect carers, such as in the case of children living with type 1 diabetes where parents may need to reduce their work commitments to provide adequate supervision and care to their child with diabetes. People living with diabetes may also need to take time off to manage episodes of high blood glucose. They can also experience 'presenteeism', which can also occur in people with undiagnosed symptomatic diabetes; this refers to the fact that people are present at work but have reduced productivity due to health issues such as fatigue or other symptoms that stop them from performing at their best. In severe cases, diabetes complications (such as kidney complications, cardiovascular disease, neuropathy and vision problems) can lead to reduced work hours, job losses or early retirement. This may particularly be the case for more physically demanding jobs or jobs which require consistent high levels of concentration. These issues can result in significant reduction in income and contributions to superannuation, which means that individuals will require government support as they age.

Cost of living pressures

In addition to the numerous costs already identified, the increasing cost of living across Australia is impacting the diabetes epidemic.

Research undertaken by the Australian Bureau of Statistics and UQ, published in 2023, found the price of healthy food rose at double the rate of junk food, and the price difference between healthy and unhealthy food was at its highest since 2019 [64].

When foods with a low nutritional value become more affordable, a healthy diet can become less accessible. On a population-wide scale this can lead to increased rates of overweight and obesity, both of which are risk factors for type 2 diabetes.

The shortage of bulk billing General Practitioners also adds an additional financial burden for people who are already struggling to make ends meet. Unfortunately, this can result in inadequate diagnosis, prevention, and treatment of diabetes, which increases the risk of serious complications.

4.4 The impact of COVID-19

The full impact of the COVID-19 pandemic on people at risk of, or living with, diabetes remains unclear. However, the impacts of COVID infection on people living with diabetes were significant. Studies have shown that

people with diabetes were at a substantially increased risk of death from COVID-19.

In 2020–21, type 2 diabetes was the most common comorbid condition of hospitalisations that involved COVID-19 [1].

In Australia, diabetes was a pre-existing condition in 15.7% of the doctor-certified deaths with a chronic condition listed on the death certificate during the pandemic [1]. This was also observed globally [65].

During the pandemic, the rate of HbA1c testing among people with type 1 and type 2 diabetes decreased significantly [1]. Although testing levels have started to recover since the pandemic, visits to diabetes educators have yet to return to pre-pandemic levels, indicating that people with diabetes have missed routine and regular follow-up and checks to manage their diabetes.

This reduction in service provision could lead to ongoing disengagement from the healthcare system, with people feeling relatively well and therefore not seeing the need to visit healthcare providers until complications arise. This, in turn, could result in a significant increase in serious complications in the years to come.

While data on this is not yet available, it is important to consider further research and preparedness for this potential downstream consequence of living through the pandemic with a chronic condition such as diabetes.

5. Which groups are most affected?

The risk of developing type 2 diabetes and GDM is higher in certain demographic groups including Aboriginal and Torres Strait Islander people, and culturally and linguistically diverse communities. These risk factors are genetic and affected by the social determinants of health. Pregnant women and the elderly are also significantly impacted groups.

Some of the challenges for vulnerable and priority groups are that the available information and support around diabetes is provided by a health system that is fragmented and complex. This landscape can be challenging for people to navigate and is compounded by a range of funding mechanisms at both state/territory and federal levels.

The availability of specific resources to support these cohorts of people has generally been limited. While awareness of more nuanced and tailored prevention and support strategies is increasing, more research is needed to understand what is most effective for these populations. It is also important to note that very often these are groups of people that are under-represented in clinical trials and other research studies.

5.1 Aboriginal and Torres Strait Islander people

Diabetes disproportionately affects Aboriginal and Torres Strait Islander communities in Australia.

Based on self-reported health survey data, 7.9% of all Aboriginal and Torres Strait Islander people are estimated to be living with diabetes [66]. Overall, Aboriginal and Torres Strait Islander people are three times more likely to develop diabetes than non-indigenous Australians [1]. The actual prevalence of diabetes amongst Aboriginal and Torres Strait Islander people is higher than the self-reported data might suggest and varies geographically. For example, in central Australia's remote areas, a study found that 40% of Aboriginal adults had been diagnosed with diabetes [67], marking the highest recorded diabetes prevalence documented globally. Furthermore, the same study showed that overall prevalence of diabetes amongst adult Aboriginal populations in the Northern Territory has increased, from 14% in 2012 to 17% in 2019 [67].

Aboriginal and Torres Strait Islander communities also face the world's highest rates of youth-onset type 2 diabetes. The prevalence of diabetes in Aboriginal and Torres Strait Islander young people aged 15-24 years has doubled over the past five years [68]. Among these, young women between the ages of 20 and 39 years are particularly affected, further leading to a high prevalence of pre-existing diabetes in pregnant Aboriginal women. One study found that 8.4% of pregnant Aboriginal women in central Australia had pre-existing diabetes [69]. The prevalence of GDM is also high in remote Aboriginal populations and continues to rise.

Among Aboriginal women, the prevalence of GDM increased from 3.4% in 1987 to 13% in 2016 [69]. Pre-existing and gestational diabetes increase the risk of pregnancy complications and cardiometabolic disease in mother and child, and increase the child's risk of early obesity and type 2 diabetes, continuing an alarming intergenerational trend [70,71].

In addition, the rate of preventable hospitalisations for complications associated with type 2 diabetes is 5.2 times higher in Aboriginal and Torres Strait Islander people compared to other Australians [72]. In the NT, Aboriginal and Torres Strait Islander people experience the highest global instances of severe diabetes-associated complications such as chronic kidney issues and lower limb amputations, further underscoring the important health disparities affecting these communities [73,74].

Tragically, diabetes-associated death rates are estimated to be 4.4 times higher among Aboriginal and Torres Strait Islander people compared to other Australians [1].

Furthermore, diabetes has emerged as the leading cause of death among Aboriginal and Torres Strait Islander women nationally and across the entire Aboriginal demographic in the Northern Territory [75].

5.1.1 Social determinants of health

Social determinants of health, as recognised by the World Health Organization, are the range of economic, social and environmental factors that can impact a person's health and well-being. These non-medical factors have been recognised to have an important influence on health inequities and the disproportionately high burden of disease carried by disadvantaged populations. Such factors are major contributors to the high prevalence of type 2 diabetes amongst Aboriginal and Torres Strait Islander people.

The impacts of colonisation and transgenerational trauma have substantial effects on Aboriginal and Torres Strait Islander populations that contribute to increased diabetes risks. These include poor mental health, food insecurity and access to healthy foods, and poor living conditions [76].

Food insecurity is a significant barrier to a healthy and nutritious diet, particularly in rural and remote communities. This includes a lack of availability of affordable healthy foods and clean water, challenges regarding the preparation, cooking and storage of food due to overcrowded living conditions, limited cooking facilities, and a lack of access to refrigeration [77]. Food insecurity may worsen in certain periods due to weather conditions and flooding. Traditional bush food sources may also become compromised at times due to environmental factors, further restricting access to healthy food options.

Diabetes-related stigma has been shown to have a considerable impact on diabetes practises amongst Aboriginal and Torres Strait Islander people. Stigma and shame may become a barrier for participation in diabetes education activities, and engagement with diabetes treatment and long-term

management programs. Studies have shown that feelings of shame, forgetfulness and stress all negatively impact diabetes self-management [78–80].

5.2 Diabetes in pregnancy

Over the next decade, more than 500,000 Australian women are expected to develop GDM [81]. In 2021-22, approximately 1 in 6 women between the ages of 15 and 49 years who gave birth in hospital were diagnosed with GDM during their pregnancy [1]. Women with GDM are twice as likely to experience cardiovascular events postpartum, such as stroke, heart failure and myocardial infarction [11], and are almost 10 times more likely to develop type 2 diabetes compared with those who had a normoglycaemic pregnancy [10]. Further to this, children born to mothers with GDM are at higher risk of developing type 2 diabetes and obesity, meaning diabetes is rapidly becoming an intergenerational condition [82].

In addition to the risk of developing GDM during pregnancy, increased rates in type 1 diabetes and earlier onset of type 2 diabetes mean an increase in pregnant women with pre-existing diabetes [69]. All types of pre-existing diabetes place women and children at an increased risk of complications during and post-pregnancy. This includes congenital malformations, which are four to ten times more likely to occur in pregnant women with diabetes, as well as a four times higher risk of pre-eclampsia and stillbirth [9,83]. An Australian study confirmed these findings, and showed that the rates of poor maternal and foetal outcomes were comparable between type 1 and type 2 diabetes [84].

Pre-pregnancy planning is essential for reducing adverse outcomes among women

with pre-existing diabetes, and specialised obstetric care is needed for this group of women; however, this can be difficult to access [85]. There are current gaps in service for women to engage with pre-conception and early pregnancy care to achieve a healthy weight to reduce the chances of developing GDM.

Women diagnosed with GDM require specialised health care from a multidisciplinary team that includes their GP, a CDE, an Accredited Practising Dietitian, an obstetrician, a midwife, and an endocrinologist. Evidence suggests that this care can be inconsistent or lacking. This situation is especially pronounced in rural areas with a recent audit showing rural women are less likely to receive education or medical treatment and are less likely to achieve optimal glucose management [86]. Additionally, GDM education and care is not currently covered by Medicare or many private health insurance policies. This means many women receiving pregnancy care in the private sector either pay private practitioners or, if they are unable to meet these costs, try to access services through an already overburdened public system. Therefore, women with GDM or pre-existing diabetes miss out on diabetes education altogether or are seeking support from a highly dispersed health care team.

5.3 Culturally and Linguistically Diverse (CALD) communities

The prevalence of diabetes is higher in some CALD communities in Australia compared to the Australian-born population, particularly for people originating from the Pacific Islands, Middle East, South Asia and Africa [87]. People from these communities are also at higher risk of hospitalisation for certain diabetes-

related complications when compared to Australian-born people, such as lower limb amputations [88]. There are a range of potential contributing factors such as genetics, biological, behavioural and environmental risk factors, as well as socio-economic constraints, that may present significant challenges for diabetes management in these communities [88,89].

Other challenges to diabetes management stem from lower health literacy and difficulties in accessing and navigating an unfamiliar health system (including access to reimbursed services) [90].

Source: Australian Institute of Health and Welfare. Chronic health conditions among culturally and linguistically diverse Australians, 2021.

| Region | Prevalence of T2DM |
|---|--------------------|
| Pacific Islands (Fiji, Samoa, Tonga) | 14% - 17% |
| Middle East (Iraq, Egypt) | 8% - 14% |
| South Asia (Myanmar, Sri Lanka) | 8% - 11% |
| Africa (Southern and Eastern; combined) | 9% |

5.4 People in socio-economically disadvantaged areas

Social inequity and socioeconomic disadvantage can contribute negatively to health outcomes in a number of ways, including income and social protection, food insecurity, education, employment and job

insecurity, housing, and access to affordable health services [91]. Geographic areas of disadvantage also experience a lack of supportive environments. It can be difficult to maintain an active lifestyle in places where there are no safe pathways with appropriate lighting on which to exercise, or parks with shade.

People living in the most socio-economically disadvantaged areas of Australia are 1.8 times more likely to be living with diabetes than people living in the least disadvantaged areas [1].

This also extends to the risk of having diabetes complications that lead to hospitalisations. People that live in Australia’s most disadvantaged communities are twice as likely to be hospitalised for diabetes [1] and 2.5 times more likely to be hospitalised for preventable diabetes-related complications compared to those in the least disadvantaged communities [92].

5.5 People living in rural and remote areas of Australia

People living in rural and remote areas of Australia are at a higher risk of developing diabetes and experiencing associated complications. They are 1.3 times as likely to be living with diabetes compared to people residing in major cities [1]. A National Community Consultation Survey by Diabetes Australia showed that 40% of respondents in regional areas faced challenges in securing appointments with their GP or other healthcare providers [93]. In another study, people in metropolitan areas with diabetes visited their GP almost 5 times per year on average; however, for people living in regional and remote Australia, this was reduced to almost four times per year on average [39].

As a consequence, in these communities there is reduced access to diabetes medication and management [94]. This is reflected in lower per capita utilisation of MBS and PBS benefits in remote areas compared to national averages [95]. This is likely a key factor contributing to the higher hospital admission rates and mortality associated with diabetes in remote and very remote Australian areas. People living with diabetes in remote and very remote Australia are 2.5 times more likely to be hospitalised due to diabetes complications than those in major cities, and mortality rates are 2.2 times as high than for people living in urban and metropolitan areas [1].

Telehealth services can play an important role in providing access to diabetes care for people living in rural and remote areas.

5.6 Older people

According to the NDSS, almost 1 million people that live with diagnosed diabetes are aged over 60. Of these, 250,000 are aged over 80 [12]. Currently, one in five people living in residential aged care facilities live with diabetes [96]. This proportion increases to one in four for Aboriginal and Torres Strait Islander people.

People aged 60 and over are at a higher risk of hospitalisation for diabetes-related complications, such as stroke, myocardial infarction and heart failure [97]. The number of comorbid conditions and potential cognitive decline that some older people live with may also increase the challenges of living with diabetes and preventing serious complications.

For older Indigenous Australians, the age range of 50 and over is used, reflecting the life

expectancy gap between Indigenous and non-Indigenous Australians and the smaller proportion of Indigenous people aged 65 and over.

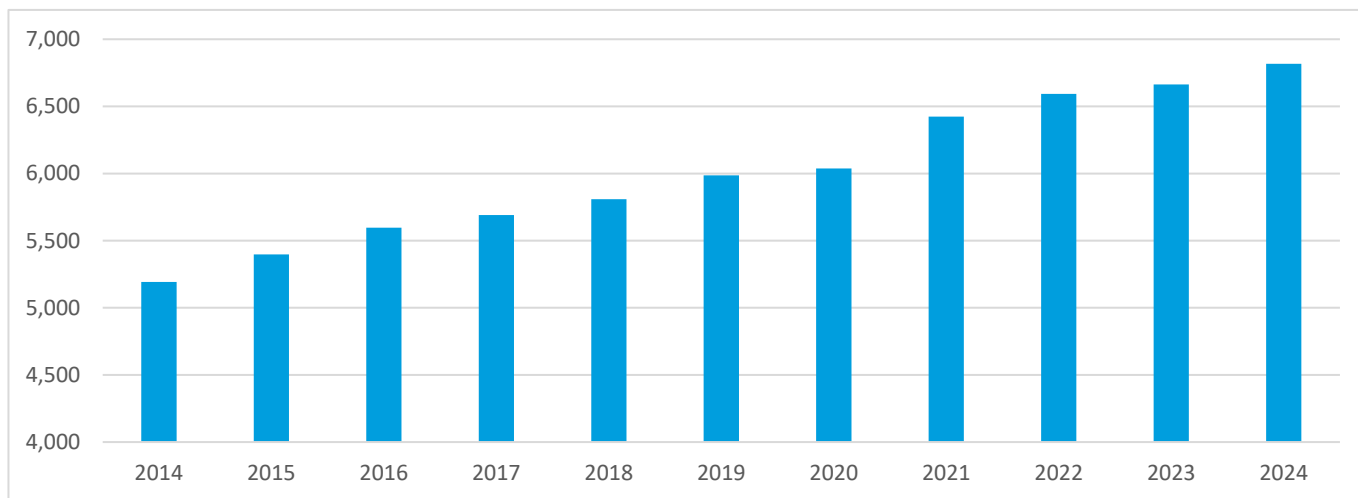
The management of diabetes in aged care facilities can be particularly challenging. Specific care needs include special dietary requirements, the need for assistance with glucose monitoring and help with administering insulin. Gaps in meeting these needs can negatively impact aged care facility residents living with diabetes, causing preventable health complications, avoidable hospitalisations and premature death. These issues can be compounded by a lack of awareness about diabetes from residential care facilities.

Australia's population is ageing. It is expected that by 2050, almost a quarter of Australians will be aged 65 or over, and the number of Australians over 85 years will double [98]. Given the prevalence of diabetes is also increasing, this means that we can expect significant increases in the number of older Australians living with type 1 and type 2 diabetes in the future – placing a large burden on communities and the overall economy.

5.7 Children and young people

Diabetes diagnoses have increased 17% in people under the age of 20 in the past 10 years. In people aged 21 to 39 years, the number has increased by 44% [12].

Number of 21 - 29 year olds with type 2 diabetes. Source: NDSS Snapshot Data



The impacts of early-onset diabetes are significant. Prevalence of type 1 diabetes in children and young adults is comparatively high compared to older people [1]. For young people with type 1 diabetes, intense support when newly diagnosed leads to an improved trajectory of glycaemic outcome. Early specialist multidisciplinary care in this age group is critical and leads to improved outcomes in the long term.

Globally, cases of early-onset type 2 diabetes are increasing rapidly. While the exact causes of this increase are not known, risk factors include being born to a mother with type 2 diabetes, having a sedentary lifestyle, being overweight or obese, living in a socioeconomically disadvantaged area, having a low birth weight, and being female [99].

The impact of early-onset type 2 diabetes is serious, the risks of complications appear to be more severe, and the response to treatment is often more limited. While more research is needed to fully understand the impact, a diagnosis of type 2 diabetes when a person is young and still developing, could result in more serious complications that

occur more rapidly [100]. Of course, compounding this is the fact that if people are diagnosed with type 1 or type 2 diabetes at a younger age, they will be living with diabetes for a longer time. This means more time at risk of developing serious complications, mental ‘burnout’ and depression associated with long-term diabetes management.

It is notable that, despite the increasing numbers of early-onset type 2 diabetes, the research-based information about its true impact is limited. Clinical studies have traditionally included only participants aged 18 and over. This also extends to research around the most effective prevention and management strategies for children and younger adults with type 2 diabetes; the support and management programs that are currently available have typically been designed for adults. Further research targeted at this cohort is needed. A recently published guideline for the management of type 2 diabetes in young adults constitutes an important step forward and illustrates the need for clinical resources specific to this demographic group [101].

For children who are diagnosed with diabetes, the transition from adolescence to adulthood also presents a unique challenge as they become more independent and responsible for their own healthcare. Anecdotally, children usually receive good quality care from specialist centres and are well monitored and supported to manage their diabetes. As children become adults, they are no longer

eligible for support from children's centres and may become "lost in the system". This can be particularly acute as young adults leave home and have to learn to manage much more than their diabetes (such as living alone/without parents or guardians), and consequently run the risk of under-managed diabetes leading to serious complications [102,103].



6. How is Australia responding?

Australia has an excellent foundation for limiting the impact of diabetes including universal health coverage through Medicare and the PBS, the NDSS, and well-trained, dedicated health professionals.

Successful programs and initiatives are also well established.

Public health campaigns about regular physical activity and good nutrition are focusing on diabetes prevention. Healthcare providers are emphasizing early detection and intervention through routine screenings, and there is an important focus on effective diabetes self-management to prevent complications. Research into new treatments, technologies and preventive measures are also underway, aiming to provide more effective interventions and reduce the burden of diabetes on individuals and the healthcare system, as well as to ultimately find a cure.

Established in 1987, and delivered since its inception by Diabetes Australia, the NDSS is a world-leading diabetes support and services scheme. An enhanced NDSS should be the backbone of a comprehensive plan to address the diabetes epidemic.

6.1 Strategic response from the Australian Government

The Australian Government has developed the Australian National Diabetes Strategy 2021-2030 (the 'Strategy') with a vision to "strengthen, integrate and coordinate all sectors to improve health outcomes and reduce the social and economic impact of

diabetes in Australia," [104]. To do this, the Strategy will:

- consider current approaches to diabetes services and care;
- consider the role of governments and the diabetes sector;
- ensure current efforts and investments align with identified needs;
- maximise the efficient use of healthcare resources, and;
- articulate a vision for preventing, detecting and managing diabetes.

A funded Implementation Plan and indicators for measuring progress are currently under development. These are necessary to ensure the effectiveness of the Strategy.

Alongside the Strategy, the Minister for Health and Aged Care referred a parliamentary inquiry into diabetes, focusing on the prevention, diagnosis and management of all forms of diabetes and obesity, and its effects on the Australian population [105]. The outcomes of the parliamentary inquiry are expected by mid-2024.



6.2 Prevention

Currently type 1 diabetes cannot be prevented. However, researchers are studying autoimmune processes and environmental factors to prevent people from developing type 1 diabetes in the future.

Large scale, randomised controlled trials of people living with pre-diabetes or at high risk of developing type 2 diabetes have shown that the condition can be prevented or delayed in up to 58% of people through behavioural change programs supporting weight loss, increasing physical activity and enabling healthier eating patterns [106,107]. Studies have shown these lifestyle interventions can have positive impacts lasting up to 20 years following the active intervention, including reduced risk of cardiovascular disease, stroke, other chronic conditions and some cancers [108].

Type 2 diabetes prevention is one of the most cost-effective interventions in chronic disease.

Diabetes Australia operates high risk type 2 diabetes and chronic disease prevention programs in Queensland, New South Wales and Tasmania. Diabetes Australia's member organisation, Diabetes Victoria, operates a similar program in that state.

Broad national chronic disease prevention strategies are in place across Australia, but none that specifically target diabetes.

The absence of a national type 2 diabetes prevention program is a substantial missing link in efforts to decrease the number of people living with type 2 diabetes.

6.2.1 Population-wide prevention

Population-wide diabetes prevention is critical. These approaches, which focus on the whole population regardless of risk, aim to achieve positive behaviour change and encourage healthy choices through awareness campaigns, policy settings or regulation.

The Australian Government's *National Diabetes Strategy 2021-2030* recommends a community and workplace-based approach for the general population. It includes 12 areas for action such as: supporting the development of health-promoting environments that encourage healthy diets, increasing physical activity (including active travel), preventing unhealthy weight gain, and reducing sedentary behaviour; as well as regular reviews of the Australian Dietary Guidelines; and increasing the availability of and demand for healthier food and beverages while reducing the availability of and demand for unhealthy food and beverages [104].

Population-wide prevention strategies that encourage overall health and wellbeing have the advantage of reducing the risk of multiple chronic diseases, along with diabetes. Lifestyle programs that support the general public to maintain a healthy diet and an active

lifestyle have the potential to contribute to overall improvements in other chronic conditions including obesity, heart disease and blood pressure conditions. Other initiatives that support population-wide prevention include ensuring healthy food is

affordable, food labelling, reducing unhealthy food and drink advertising, and investing in structural environments that promote physical activity (e.g. safe footpaths and green spaces).

Sugary drinks levy

The introduction of a levy on sweetened beverages has been proposed as a public health measure in Australia in recent years. Diabetes Australia, the Australian Diabetes Society and the Australian Diabetes Educators Association strongly support the introduction of a 20% health levy on sugar-sweetened beverages, as part of a comprehensive approach to diabetes prevention. Sugary drinks are the largest source of free sugars in the Australian diet [109]. The Australian Medical Association estimates Australians drink at least 2.4 billion litres of sugary drinks every year – the equivalent of 960 Olympic-sized swimming pools [110].



6.2.2 High risk type 2 diabetes and GDM prevention

Prevention programs operating at a state-wide level target people most at risk of developing type 2 diabetes. However, there is currently no systematic approach to this across Australia.

To prevent type 2 diabetes from developing in people with pre-diabetes, one of the primary interventions is lifestyle modification aimed at losing weight. However, research has found that competing priorities, limited time available for consultations and a lack of expertise in nutrition made it difficult to discuss diets and weight loss strategies at GP appointments [111]. Multiple guidelines recognise that individualised care is needed with a GP as the lead coordinator supported by a multidisciplinary team (typically including diabetes education and nutritional support/education). However, few people with pre-diabetes, as well as those already living with type 2 diabetes, receive a referral to a dietitian or nutritionist from their GP. This concern is well established amongst Australian dietitians [112].

Currently in Australia, people with pre-diabetes are only eligible for reimbursed care plans if they have another chronic health condition. Such care plans include five visits to allied health professionals. This means that people with cardiovascular diseases and/or type 2 diabetes qualify for these plans, while people living with pre-diabetes alone do not qualify, despite being a key risk factor for both cardiovascular diseases and type 2 diabetes. This is a missed opportunity for earlier prevention of type 2 diabetes.

Preventing the development of type 2 diabetes after a GDM diagnosis, and type 2

diabetes in children of mothers who had GDM, is also critical.

There is a clear need for more programs assisting women to reduce their risk post-pregnancy.

These programs would include initiatives such as annual reminders to have type 2 diabetes checks for five years after their GDM diagnosis, as is currently undertaken through the National Gestational Diabetes Register and linking women with prior GDM to structured lifestyle programs.

The prevention of GDM is also an important focus. Pre-conception is a key opportunity to support more women to achieve a healthy weight and lifestyle as part of the pregnancy planning process. Studies have shown that moderate intensity lifestyle interventions in women at high risk during early pregnancy can reduce their risk of GDM by 41% [113].

However, few women have the opportunity to engage in supported pre-conception care to obtain a healthy weight prior to pregnancy. New approaches for pre-pregnancy planning are required including:

- More encouragement for women to plan pregnancies including improving access to safe, reliable contraception;
- Better access to pre-pregnancy assessment via a women's GP or a local pre-pregnancy service, via a hospital or other primary or tertiary care settings, including funding the expansion of these services;

- More encouragement for women to attend pre-pregnancy assessment with their GP or local pre-pregnancy services; and
- Systematic access to healthy lifestyle programs for those with prior GDM, as occurs in the UK NHS Diabetes Prevention Program.

6.2.3 Culturally appropriate prevention and management for vulnerable groups

In order for type 2 diabetes prevention in Aboriginal and Torres Strait Islander populations to be effective, it is imperative that they are spearheaded by members of those communities. This implementation of culturally appropriate care and education ensures that initiatives are customised to cater to the specific requirements of the people they are intended to assist [114,115].

Interventions aimed at improving cultural safety for Indigenous people who have diabetes can have positive impacts on clinical outcomes [116]. These interventions include educating healthcare professionals, modifying clinical environments to promote culturally safe practices, and integrating Indigenous health professionals into the workforce. Sectors outside of healthcare also play an important role in improving health outcomes. Local council planning instruments, education facilities and public transport accessibility all contribute.

It is also important to consider adapting public health messages and education about diabetes to different target audiences. This can be achieved through community-based participatory action research and co-designing interventions led by local community members. By doing so, the information can be provided in a format and

language that is appropriate and engaging to local communities.

6.2.4 Screening and early diagnosis

Better detection of undiagnosed type 2 diabetes will ensure people are in the best position to attempt type 2 diabetes remission, or achieve optimal management of the condition early and prevent complications. Many people live for an average of seven years before the condition is detected, often after a complication has developed [117,118]. Type 2 diabetes screening is encouraged amongst all Australians aged over 40 years, with a particular focus on people with significant risk factors.

Opportunistic screening supports earlier diagnosis.

A trial of pharmacy screening for diabetes was led by the Pharmacy Guild of Australia between October 2017 and November 2018. The trial compared the effectiveness of three pharmacy-based screening models in detecting type 2 diabetes [119]. Over 14,000 people were screened in 339 pharmacies during the trial. The Australian Government is currently considering the results of the trial in order to inform future decisions about any broader rollout.

Diabetes screening in primary care settings is also important. Organisations including the Royal Australian College of General Practitioners have highlighted the need for MBS rebates to support the screening of high risk individuals in primary care [120].

The uptake of point-of-care testing by healthcare practitioners has been lower than expected, possibly due to the costs of maintaining and validating the equipment required to process the samples taken. Where testing does happen, appropriate referrals and wraparound services must be made available. Diabetes workforce limitations and a dearth of diabetes-specific MBS items further compound the issue.

6.3 Preventing complications

Many diabetes-related complications are preventable or can be substantially delayed if identified early, when medical interventions are most effective. Investing in timely diagnosis and treatment can not only improve the health outcomes for individuals but also bring about substantial cost savings in healthcare expenditure. Preventing complications is best achieved through regular health checks, timely treatment, and access to technologies that support the management of blood glucose levels. Technologies such as CGM devices and AID systems (which include CGM and an insulin pump) provide the opportunity for a person to manage their blood glucose levels in an ongoing and effective way. This can substantially reduce the risk of complications.

Appropriate access to care and treatment is, of course, dependent on resourcing the diabetes health workforce. By ensuring regular care from a team of health professionals, complications can be prevented or identified and treated early, reducing their impact.

6.4 Integrated models of care

Successful diabetes care and management requires the collaboration and cooperation of

health care teams across both primary and secondary care, along with the person living with diabetes. The development of integrated models of care that allow for collaboration around case planning and overall care from an endocrinologist and primary practice can improve the experience and health outcomes of people living with diabetes [121].

The majority of diabetes management and review for type 2 diabetes occurs in the primary care setting. This means that GPs need to be upskilled and educated to provide the best care they can, but also to recognise when a person requires specialist intervention. People must also be empowered to self-manage their diabetes through education based on consistent and reliable resources. The NDSS fulfills a key role in this by providing registered people living with diabetes access to a range of educational resources and programs delivered by local diabetes organisations.

Importantly, there will be no 'one size fits all' approach to managing diabetes, particularly for vulnerable groups. A range of models of care have been developed, with governance, finance, education and enablement of those with diabetes, improved communication and collaboration at their core. Adopting case-conference approaches can be an effective mechanism that include the person living with diabetes, GP and tertiary specialists (including endocrinologists) as a whole in the management of an individual's diabetes. A prime example of this approach is the Western Sydney Diabetes Initiative [122].

New approaches for coordinated care are needed.

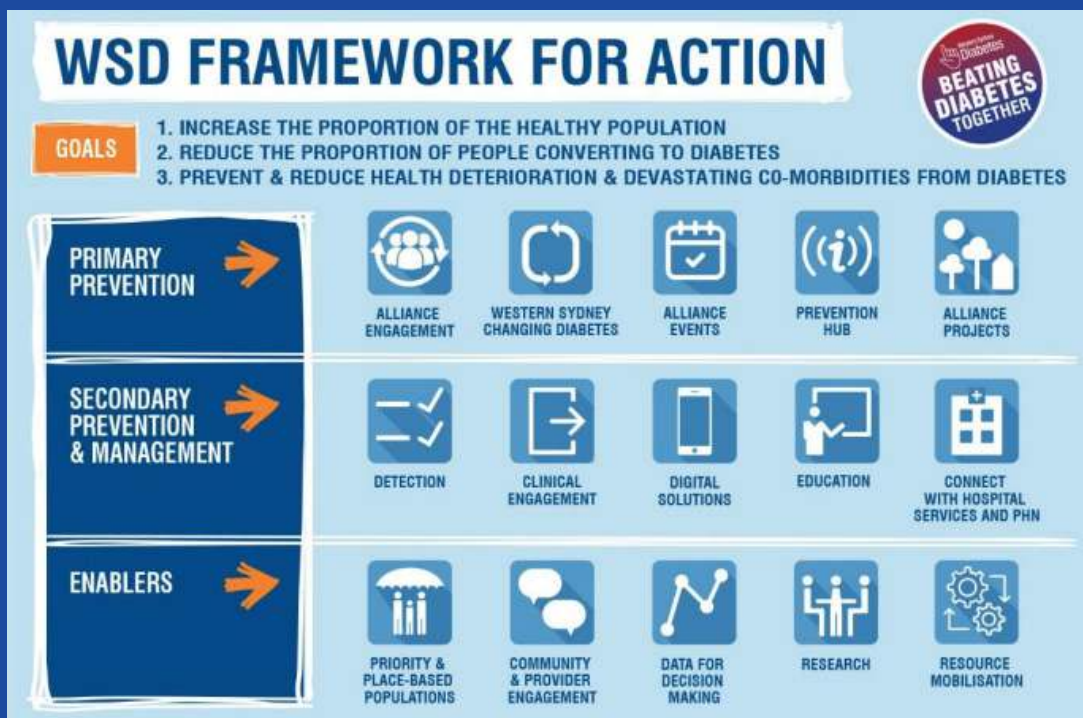
“Australia has developed a number of very effective approaches to better coordinate and integrate diabetes services across primary and secondary care around the needs of the person living with diabetes. It is now time to develop and implement the funding and organisational frameworks needed to extend these approaches, tailored to their setting, across our country.”

Professor David Simmons
Chief Medical Officer, Diabetes Australia



Western Sydney Diabetes (WSD) has been established in response to the growing levels of diabetes in the community. A public-private partnership with FTE of 15.8 and annual budget of around \$2.4m (as of 2021), the initiative recognises that diabetes is “everybody’s business” and so it is a partnership between community health services, general practice, hospitals, specialists and allied health so that people at risk or living with diabetes have access to more integrated and comprehensive diabetes services.

WSD Framework for Action and the goals underpin the work of WSD and comprises three major sections including Primary Prevention, Secondary Prevention and Management and Enablers, with key indicators under each. One of the key aspects of success has been the model of care that adopts a ‘case-conferencing’ approach where GPs and tertiary specialists (potentially with other allied health professionals) and the patient meet together to develop and/or discuss management approaches. This format allows the GPs to upskill and the patients are more empowered to self-manage their condition.





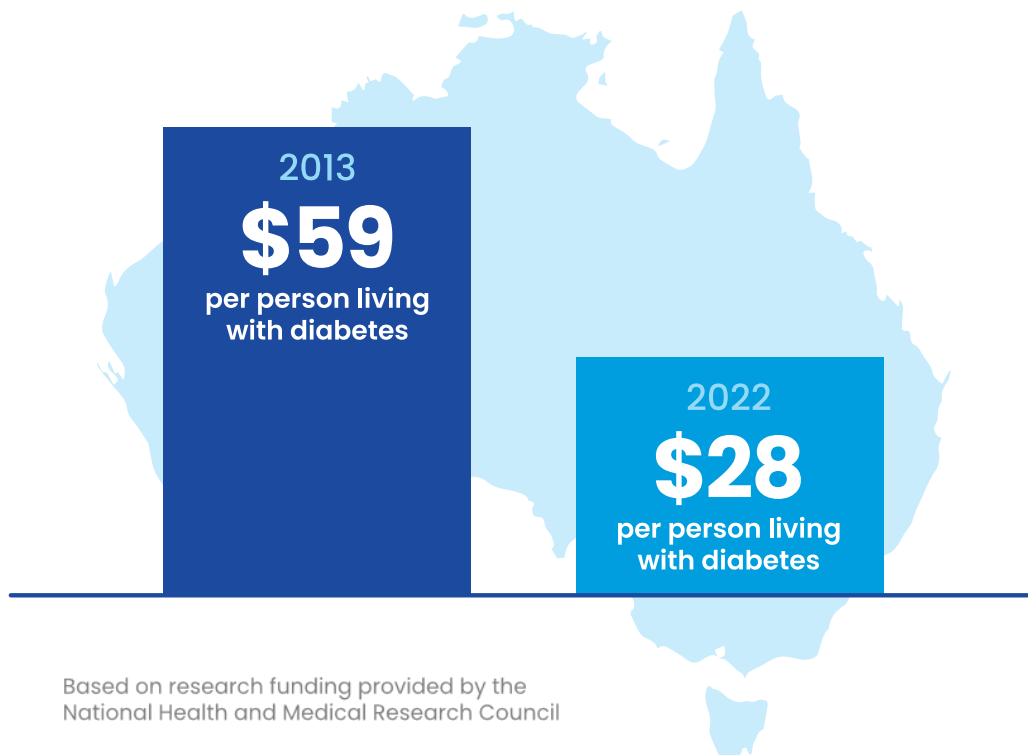
7. Looking ahead: further action is crucial

Although a range of actions are currently being implemented, it is crucial to identify further solutions that will most effectively combat the diabetes epidemic across future generations. These initiatives will require additional investment, but they represent the key steps that will be required in the coming years.

7.1 Investment in diabetes research

Urgent funding is needed to support ongoing diabetes research.

Despite a 32% increase in the number of people living with diabetes in Australia over the past decade, there has been a significant decline in diabetes research funding. A key example is National Health and Medical Research Council (NHMRC) funding for diabetes-related research which has fallen drastically from a total of \$70.3 million in 2015 to only \$19 million in 2023.



More generally, the decrease in funding for diabetes is likely to have longer-lasting impacts on the whole research ecosystem associated with diabetes. Without sustainable funding, there are fewer opportunities for PhDs and less support for early career researchers and clinician-researchers to build an impactful research portfolio. It is essential to ensure support for the next generation of diabetes researchers in Australia. Without appropriate funding and opportunities in place, young health researchers will gravitate away from diabetes research. These risks creating a diabetes research void in the future, with little scope for further Australian diabetes research to help inform Australian health policy and practice.

As noted throughout this report, there are significant gaps in the understanding of the true prevalence and burden of living with diabetes and its subsequent complications. While there are a range of tools and technologies available to assess the risk and formally diagnose diabetes, the use of these varies nationally. Without expanded screening and surveillance it is challenging to know the true scale of the diabetes epidemic in Australia. Understanding the incidence of diabetes in vulnerable groups, particularly Aboriginal and Torres Strait Islander people, and how this compares with national trends, would improve visibility on population groups that are more at risk of diabetes and its complications. Improvements in this area could facilitate more tailored approaches and targeted interventions where necessary.

We currently have a limited understanding of the more intricate reasons why some people develop diabetes and associated complications while others do not. We know that there are several important risk factors, with obesity playing a major role for type 2

diabetes specifically. However, not all people who are obese develop type 2 diabetes, suggesting that there is a genetic predisposition at play. More multidisciplinary research is needed in this area to gain a comprehensive understanding of the interplay of risk factors, both modifiable (such as lifestyle factors) and fixed (such as genetic predisposition). A deeper understanding would enable more evidence-based and targeted diabetes prevention and management strategies to be developed. This extends to the recently documented increase in the earlier onset of type 2 diabetes and the associated risk of rapidly developing complications. Gaining research-based insights in the factors that are driving this trend could inform prevention strategies and self-management practices. The links that diabetes has with other comorbid conditions, such as mental health, cancer and infections are also not fully understood.

The timely delivery of optimal care is a key factor in preventing diabetes complications and maintaining good quality of life. More research into cost-effective diabetes health services delivery in the Australian context is required to ensure more rapid translation of evidence into practice.

To improve prevention and treatment strategies for diabetes, it is important to understand the impact of lifestyle and diet programs compared to medication-based approaches. There is a need to identify the barriers preventing people from adopting healthy lifestyle changes and determine how to overcome them. The co-design of studies through collaborations with people living with diabetes, healthcare providers, and other stakeholders could lead to more cost-effective and clinically relevant interventions.

In addition, a deeper understanding of the stigma associated with diabetes and how it affects health-seeking behaviour and outcomes would be beneficial.

The concept of diabetes remission for type 2 diabetes is gaining interest internationally, particularly in the UK [123]. Diabetes remission is defined as a sustained improvement in blood glucose where HbA1c levels remain below 6.5% for at least 3 months in the absence of glucose-lowering medications [124]. Diabetes remission appears to be driven by weight loss and this can be achieved through diet, bariatric surgery or with weight loss medications. While this concept can be encouraging for people with type 2 diabetes, it is important to acknowledge that this is not a “cure” and can be difficult to achieve and maintain. Further research is needed to expand the knowledge base around achieving and maintaining remission, and the impact of remission on regular diabetes checks and complications.

There is a need for more research to promote innovation, and investigate new medications and technologies relevant to the Australian context. Ideally, these studies should be conducted in Australia, taking into account the challenges of including vulnerable and priority populations such as pregnant women, children, people with mental health conditions, the elderly, and CALD communities. Moreover, the research should be designed in a way that allows for easy translation of the results into practice, and reimbursement for people should be expedited.

7.2 Solutions for the health system

Easing pressure on the health system is more important than ever, as the cost of diabetes continues to increase.

7.2.1 Preventing hospitalisations

Investing in programs and integrated models of care that promote effective diabetes management can prevent complications which cause hospitalisation. While this is a key area of focus, more work is required to drastically reduce preventable hospitalisations.

In 2017-18 6.6% of public and private hospitalisations (almost 748,000) were potentially preventable [92]. Forty-six percent of those hospitalisations were for people aged over 65 and the majority of those were for chronic conditions including type 2 diabetes complications.

In addition, people living in the most disadvantaged communities in Australia (SEIFA 1) are 2.5 times more likely to be hospitalised with a potentially preventable diabetes-related complication compared to those in the least disadvantaged communities. These preventable hospitalisations place additional financial and workforce pressures on hospitals.

The National Diabetes Strategy calls for better promotion of hospitalisation prevention strategies and complication prevention programs in Primary Healthcare Networks and across the health system more generally.

These could include community-based interventions such as telemedicine, education, and models of care that promote integration.

Other initiatives such as Victoria's new virtual emergency department for people living with diabetes have the potential to provide emergency care in their home, potentially reducing pressure on ambulance services and hospital emergency departments. This initiative is a prime example of innovative models of care that can reduce hospitalisations.

Ongoing care from a CDE can also prevent hospitalisation. The NDSS annual cycle of care recommends that a person living with diabetes receives at least 4, and up to 17, allied health visits per year. These visits are important for diabetes management. Unfortunately, less than 10% of people living with diabetes access a CDE through a GP referral to receive this care.

The introduction of MBS funding for CDE visits for people at increased risk of diabetes-related complications would improve ongoing care and reduce the risk of hospitalisation.

Another initiative that can prevent hospitalisation is support for a culturally safe workforce, particularly for Aboriginal and Torres Strait Islander people, and CALD communities. When people living with diabetes feel safe and comfortable with their health care provider, they are more likely to engage in regular health checks which can prevent complications.

7.2.2 Improving care in hospital

Up to 40% of hospital inpatients are living with diabetes. Blood glucose levels can fluctuate during hospital stays, which can lead to complications and longer lengths of stay. Elevated blood glucose levels during hospitalisation has been linked to greater infection risks, slower wound healing, and higher mortality rates [130].

AIHW data from 2003-2004 found that the average length of hospital stay for a person living with diabetes was more than three times the overall average [131].

Appropriate management of hyperglycaemia while in hospital is critical to improving clinical outcomes. This can be supported through ongoing review of the use of oral and non-insulin injectable glucose lowering agents; close attention to insulin dosage; upskilling of non-specialist hospital staff; and nationally consistent diabetes management protocols.

Further investment in Specialist Inpatient Diabetes Management Teams is necessary to improve outcomes in hospital for people living with diabetes. These Teams support multidisciplinary, person-centred care, and can review inpatient diabetes management on a daily basis if needed.

7.2.3 Improving access to diabetes technologies and medicines

Access to diabetes technologies needs to be more affordable and accessible, based on clinical need.

Government funding models need to be adjusted to ensure that a person living with diabetes, regardless of type, can afford to access the technology that will best support their diabetes management. This will require expanded subsidies for AID and CGM devices.

While the expansion of subsidies for CGM devices to all people living with type 1 diabetes has been warmly welcomed, Australians living with diabetes still have less access to this technology than people in other OECD countries. For instance, many countries now base eligibility for subsidised access on several clinical factors including insulin usage and hypoglycaemia unawareness rather than the type of diabetes a person has. Eligibility for subsidies in Japan, the USA, Germany and France are based on whether or not a person requires multiple daily insulin injections.

These represent established, cost-effective international models of access and provide a framework to expand access to CGM and Flash GM for all people using multiple daily injections of insulin to manage their diabetes. This should include a small percentage of other people living with type 2 diabetes, estimated at around 8%, as well as people living with conditions that are very similar to type 1 diabetes, including cystic fibrosis-related diabetes, maturity-onset diabetes of the young (MODY), latent auto-immune diabetes in adults and type 3c diabetes.

It is important that Australia's regulatory and funding systems evaluate new health technology faster.



With technological breakthroughs certain to continue, Australian regulators must establish processes that allow for timely and robust evaluation.

Similarly, precision medicine and pharmacotherapies for weight management are emerging as an important aspect of diabetes prevention and management. However, the current regulatory and reimbursement systems in Australia are not well placed to efficiently consider and provide access to such novel therapies.

As noted previously, shortages of medications for the management of diabetes are already posing a significant problem for Australians living with diabetes. This is expected to continue to be a major issue throughout 2024, if not longer. Given the scarcity of pharmacotherapies and limited accessibility through subsidised channels, people may be impacted by out-of-pocket costs for their diabetes management.

The global shortage of diabetes medicines has demonstrated that more efficient methods of assessing new medicines, and then making them available based on clinical need, are required in Australia. Furthermore, when approving a new product for release to the market, regulators (the Therapeutic Goods Administration) should provide confidence to Australians that supply chains are sufficient to meet public demand.



7.2.4 Investing in the workforce

Current funding models need to be improved to ensure appropriate investment in the diabetes health workforce.

Significant changes to policy and funding models have impacted diabetes care in recent years. The MBS item for a diabetes cycle of care was discontinued in 2018 due to low uptake among GPs. This means there is now no incentive for GPs to conduct annual checks for people living with diabetes, and deliver continuity of care to ensure people living with diabetes are well educated and their condition is well managed. The lack of diabetes specificity for other MBS items makes it challenging to determine trends and make comparisons across states and

demographics regarding what care is being provided now and in the future.

In addressing the current challenges of the diabetes health workforce, the optimal utilisation of CDEs is essential. Currently, the CDE workforce is under-utilised, with the core MBS item number covering only a 20-minute appointment with a CDE. This is not long enough to deliver the blend of care and education fundamental to effective CDE care. If, through working with a CDE, a person living with diabetes develops the skills to self-manage their condition, they will be able to reduce their risk of diabetes-related complications and reduce potentially preventable primary care visits and hospital admissions. The number of MBS items for CDE appointments declined significantly during the COVID-19 pandemic and has not yet rebounded.

Leveraging the underutilised capacity of CDEs in private practice could increase the ability to be seen by a CDE, and provide a more sustainable workforce.

Presently, with 17% of CDEs operating in private settings and a substantial portion providing diabetes services on a part-time basis, there exists a significant opportunity to enhance health care by fully leveraging this untapped potential. ADEA data demonstrates that over 67% percent of CDEs have a 4 week or less waiting list for new people. In fact, only 10% have a waiting list longer than 3 months. 55% of CDEs can see existing people in a waiting time of 4 weeks or less, and 97% report they can see existing patients within 6 months. CDEs in private practice are well-positioned to manage a larger client base, reducing wait times and ensuring timely, structured diabetes education to the people who need it. [125,126]

Given their key role in diabetes management, it is notable that the Australian Diabetes Educators Association is reporting the loss of qualified CDEs due to a lack of referrals. Private practice CDEs are reporting scope to accept more clients, and more qualified CDEs would consider private practice if sufficient referrals could be guaranteed. This further contributes to the overall diabetes workforce strain.

7.2.5 A national kidney screening program

A national diabetes-related kidney disease screening program is needed in Australia.

An estimated 330,000 Australians living with diabetes have chronic kidney disease, however rates of screening remain low, with just over one in four people with diabetes having their kidneys checked within

recommended timeframes [46]. These low screening rates are caused by low awareness levels about the need for kidney checks among people with diabetes and some health professionals.

In the early stages, chronic kidney disease is asymptomatic but, if detected early, treatments and lifestyle changes can slow or halt the progression of the condition. As the condition progresses, its impacts can become much more serious and kidney damage is often irreversible.

7.2.6 Improving coordination of diabetes care

Diabetes care is unique in its complexity. While many health conditions can be managed in primary care alone, the pace of change in diabetes management, medications and technology requires specialist skills from credentialled diabetes educators, dietitians, other allied health professionals and endocrinologists. New frameworks are needed to ensure access to the highest quality of care. Building upon current integrated approaches, work is now needed across jurisdictions and with private healthcare providers, to better coordinate care around the person living with diabetes.

7.3 Future possibilities are significant

In the coming years, a myriad of approaches that creatively combat the diabetes epidemic will be essential to control its impact, and to improve quality of life for people living with the condition.

There are significant challenges, but equally significant opportunities for investment into innovative solutions to the crisis. A coordinated, national approach to identify and implement these innovations will be crucial to ensure the brightest possible future for Australians living with diabetes.

8. Summary

The *State of the Nation* report gives an overview of diabetes in Australia and provides a forecast for the future, highlighting a critical and escalating crisis. Urgent, substantial investments are necessary to curb the diabetes epidemic and improve the lives of those living with diabetes.

Urgent funding is required to support ongoing diabetes research. Reducing the strain on the national health system is increasingly important as the cost of diabetes and its complications continues to rise. Ensuring affordable and equitable access to diabetes technologies and services is essential, as is securing more funding and implementing a national prevention plan.

For decades, there have been calls for a national diabetes prevention plan. Despite up to 2 million Australians living with the condition, a national plan still doesn't exist. It is the only intervention that will protect future generations of Australians from the costly impact of living with type 2 diabetes.

This report shows immediate action is required to effectively research, treat and prevent diabetes to address a health epidemic that is one of the largest and most complex health challenges the nation has ever faced.

The health of future generations of Australians depends on this.



References

1. Diabetes: Australian facts, Summary. In: AIHW Diabetes Australian Facts [Internet]. 17 Jun 2024 [cited 17 Jun 2024]. Available: <https://www.aihw.gov.au/reports/diabetes/diabetes/contents/summary>
2. Ley SH, Schulze MB, Hivert M-F, Meigs JB, Hu FB. Risk Factors for Type 2 Diabetes. 3rd ed. In: Cowie CC, Casagrande SS, Menke A, Cissell MA, Eberhardt MS, Meigs JB, et al., editors. *Diabetes in America*. 3rd ed. Bethesda (MD): National Institute of Diabetes and Digestive and Kidney Diseases (US); 2018. Available: <http://www.ncbi.nlm.nih.gov/books/NBK567966/>
3. Zhang Y, Pan X-F, Chen J, Xia L, Cao A, Zhang Y, et al. Combined lifestyle factors and risk of incident type 2 diabetes and prognosis among individuals with type 2 diabetes: a systematic review and meta-analysis of prospective cohort studies. *Diabetologia*. 2020;63: 21–33. doi:10.1007/s00125-019-04985-9
4. Kolb H, Martin S. Environmental/lifestyle factors in the pathogenesis and prevention of type 2 diabetes. *BMC Med*. 2017;15: 131. doi:10.1186/s12916-017-0901-x
5. Wu Y, Ding Y, Tanaka Y, Zhang W. Risk Factors Contributing to Type 2 Diabetes and Recent Advances in the Treatment and Prevention. *Int J Med Sci*. 2014;11: 1185–1200. doi:10.7150/ijms.10001
6. Cloostermans L, Wendel-Vos W, Doornbos G, Howard B, Craig CL, Kivimäki M, et al. Independent and combined effects of physical activity and body mass index on the development of Type 2 Diabetes – a meta-analysis of 9 prospective cohort studies. *Int J Behav Nutr Phys Act*. 2015;12: 147. doi:10.1186/s12966-015-0304-3
7. Ahlqvist E, Storm P, Käräjämäki A, Martinell M, Dorkhan M, Carlsson A, et al. Novel subgroups of adult-onset diabetes and their association with outcomes: a data-driven cluster analysis of six variables. *Lancet Diabetes Endocrinol*. 2018;6: 361–369. doi:10.1016/S2213-8587(18)30051-2
8. Zhang C, Rawal S, Chong YS. Risk factors for gestational diabetes: is prevention possible? *Diabetologia*. 2016;59: 1385–1390. doi:10.1007/s00125-016-3979-3
9. Negrato CA, Mattar R, Gomes MB. Adverse pregnancy outcomes in women with diabetes. *Diabetol Metab Syndr*. 2012;4: 41. doi:10.1186/1758-5996-4-41
10. Vounzoulaki E, Khunti K, Abner SC, Tan BK, Davies MJ, Gillies CL. Progression to type 2 diabetes in women with a known history of gestational diabetes: systematic review and meta-analysis. *The BMJ*. 2020;369: m1361. doi:10.1136/bmj.m1361
11. Kramer CK, Campbell S, Retnakaran R. Gestational diabetes and the risk of cardiovascular disease in women: a systematic review and meta-analysis. *Diabetologia*. 2019;62: 905–914. doi:10.1007/s00125-019-4840-2
12. Diabetes data snapshots – NDSS. [cited 29 Nov 2023]. Available: <https://www.ndss.com.au/about-diabetes/diabetes-facts-and-figures/diabetes-data-snapshots/>
13. Islam SMS, Siopis G, Sood S, Uddin R, Tegene T, Porter J, et al. *The Burden of Type 2 Diabetes in Australia During the Period 1990-2019: Findings from the Global Burden of Disease Study*. Rochester, NY; 2022. doi:10.2139/ssrn.4243704
14. Sainsbury E, Shi Y, Flack J, Colagiuri S. The diagnosis and management of diabetes in Australia: Does the “Rule of Halves” apply? *Diabetes Res Clin Pract*. 2020;170: 108524. doi:10.1016/j.diabres.2020.108524
15. Diabetes: The silent pandemic and its impact on Australia. Baker IDI Heart and Diabetes Institute; 2012 p. 27. Available: <https://baker.edu.au/-/media/documents/impact/diabetes-the-silent-pandemic.pdf>
16. Tabák AG, Herder C, Rathmann W, Brunner EJ, Kivimäki M. Prediabetes: A high-risk state for developing diabetes. *Lancet*. 2012;379: 2279–2290. doi:10.1016/S0140-6736(12)60283-9
17. Ong KL, Stafford LK, McLaughlin SA, Boyko EJ, Vollset SE, Smith AE, et al. Global, regional, and national burden of diabetes from 1990 to 2021, with projections of prevalence to 2050: a systematic analysis for the Global Burden of Disease Study 2021. *The Lancet*. 2023;402: 203–234. doi:10.1016/S0140-6736(23)01301-6
18. Magliano DJ, Chen L, Islam RM, Carstensen B, Gregg EW, Pavkov ME, et al. Trends in the incidence of diagnosed diabetes: a multicountry analysis of aggregate data from 22 million diagnoses in high-income and middle-income settings. *Lancet Diabetes Endocrinol*. 2021;9: 203–211. doi:10.1016/S2213-8587(20)30402-2
19. Kwok R, MacIsaac PR, Ekinci PE. Change the Future: Saving Lives By Better Detecting Diabetes-related kidney disease. Diabetes Australia; 2023. Available: <https://www.diabetesaustralia.com.au/wp-content/uploads/2023-Diabetes-Related-Kidney-Disease-Report-1.4-DIGITAL.pdf>
20. Ohara T, Doi Y, Ninomiya T, Hirakawa Y, Hata J, Iwaki T, et al. Glucose tolerance status and risk of dementia in the community: the Hisayama study. *Neurology*. 2011;77: 1126–1134. doi:10.1212/WNL.0b013e31822f0435

21. Change the Future: Reducing the Impact of the Diabetes Epidemic. Diabetes Australia; 2022 p. 24. Available: https://www.diabetesaustralia.com.au/wp-content/uploads/Diabetes-Australia-Report-2022_Change-the-Future_1.0.pdf
22. Mosenzon O, Cheng AY, Rabinstein AA, Sacco S. Diabetes and Stroke: What Are the Connections? *J Stroke*. 2023;25: 26–38. doi:10.5853/jos.2022.02306
23. Lazzarini PA, Clark D, Derhy PH. What are the major causes of lower limb amputations in a major Australian teaching hospital? The Queensland Diabetic Foot Innovation Project, 2006 – 2007. *J Foot Ankle Res*. 2011;4: O24. doi:10.1186/1757-1146-4-S1-O24
24. Dirani, Mohamed. Out of sight. A report into diabetic eye disease in Australia. Melbourne: Baker IDI Heart and Diabetes Institute & Centre for Eye Research Australia; 2013 p. 28. Available: <https://www.baker.edu.au/-/media/documents/impact/outofsightreport.pdf?la=en>
25. Diabetes Australia. Survey on the Mental and Emotional Impact of living with diabetes. Diabetes Australia; 2020.
26. Davis TME, Colman PG, Hespe C, Heywood SE, d'Emden M. Cardiovascular disease management in Australian adults with type 2 diabetes: insights from the CAPTURE study. *Intern Med J*. 2022. doi:10.1111/imj.15929
27. Harding JL, Shaw JE, Peeters A, Cartensen B, Magliano DJ. Cancer Risk Among People With Type 1 and Type 2 Diabetes: Disentangling True Associations, Detection Bias, and Reverse Causation. *Diabetes Care*. 2015;38: 264–270. doi:10.2337/dc14-1996
28. Tomic D, Shaw JE, Magliano DJ. The burden and risks of emerging complications of diabetes mellitus. *Nat Rev Endocrinol*. 2022;18: 525–539. doi:10.1038/s41574-022-00690-7
29. Younossi ZM, Golabi P, de Avila L, Paik JM, Srishord M, Fukui N, et al. The global epidemiology of NAFLD and NASH in patients with type 2 diabetes: A systematic review and meta-analysis. *J Hepatol*. 2019;71: 793–801. doi:10.1016/j.jhep.2019.06.021
30. Lee C-H, Lui DT, Lam KS. Non-alcoholic fatty liver disease and type 2 diabetes: An update. *J Diabetes Investig*. 2022;13: 930–940. doi:10.1111/jdi.13756
31. Heerspink HJ, Cherney DZ, Groop P-H, Matthieu C, Rossing P, Tuttle KR, et al. People with type 1 diabetes and chronic kidney disease urgently need new therapies: a call for action. *Lancet Diabetes Endocrinol*. 2023;11: 536–540. doi:10.1016/S2213-8587(23)00168-7
32. Al-Rifai RH, Pearson F, Critchley JA, Abu-Raddad LJ. Association between diabetes mellitus and active tuberculosis: A systematic review and meta-analysis. *PLoS One*. 2017;12: e0187967. doi:10.1371/journal.pone.0187967
33. Huangfu P, Ugarte-Gil C, Golub J, Pearson F, Critchley J. The effects of diabetes on tuberculosis treatment outcomes: an updated systematic review and meta-analysis. *Int J Tuberc Lung Dis Off J Int Union Tuberc Lung Dis*. 2019;23: 783–796. doi:10.5588/ijtld.18.0433
34. Kim EJ, Ha KH, Kim DJ, Choi YH. Diabetes and the Risk of Infection: A National Cohort Study. *Diabetes Metab J*. 2019;43: 804–814. doi:10.4093/dmj.2019.0071
35. Dicembrini I, Silverii GA, Clerico A, Fornengo R, Gabutti G, Sordi V, et al. Influenza: Diabetes as a risk factor for severe related-outcomes and the effectiveness of vaccination in diabetic population. A meta-analysis of observational studies. *Nutr Metab Cardiovasc Dis NMCD*. 2023;33: 1099–1110. doi:10.1016/j.numecd.2023.03.016
36. American Diabetes Association Professional Practice Committee. 1. Improving Care and Promoting Health in Populations: Standards of Care in Diabetes-2024. *Diabetes Care*. 2024;47: S11–S19. doi:10.2337/dc24-S001
37. Martin ET, Kaye KS, Knott C, Nguyen H, Santarossa M, Evans R, et al. Diabetes and Risk of Surgical Site Infection: A Systematic Review and Meta-analysis. *Infect Control Hosp Epidemiol*. 2016;37: 88–99. doi:10.1017/ice.2015.249
38. Khazai NB, Hamdy O. Inpatient Diabetes Management in the Twenty-First Century. *Endocrinol Metab Clin North Am*. 2016;45: 875–894. doi:10.1016/j.ecl.2016.06.013
39. Mazumdar S, Bagheri N, Chong S, McRae IS, Jalaludin B, Giroi F. Diabetes and the use of primary care provider services in rural, remote and metropolitan Australia. *Rural Remote Health*. 2021;21: 5844. doi:10.22605/RRH5844
40. Siopis G, Jones A, Allman-Farinelli M. The dietetic workforce distribution geographic atlas provides insight into the inequitable access for dietetic services for people with type 2 diabetes in Australia. *Nutr Diet J Dietit Assoc Aust*. 2020;77: 121–130. doi:10.1111/1747-0080.12603
41. RACP. 2023 Member Statistics and Insights Report. Sydney: Royal Australasian College of Physicians;
42. Department of Health and Aged Care. Summary Statistics, Medical Profession. [cited 30 May 2024]. Available: <https://hwd.health.gov.au/resources/data/summary-mdcl.html>
43. Alicic RZ, Rooney MT, Tuttle KR. Diabetic Kidney Disease. *Clin J Am Soc Nephrol CJASN*. 2017;12: 2032–2045. doi:10.2215/CJN.11491116
44. Gorham G, Howard K, Cunningham J, Lawton PD, Ahmed AMS, Barzi F, et al. Dialysis attendance patterns and health care utilisation of Aboriginal patients attending dialysis services in urban, rural and remote locations. *BMC Health Serv Res*. 2022;22: 251. doi:10.1186/s12913-022-07628-9
45. Scholes-Robertson N, Gutman T, Howell M, Craig JC, Chalmers R, Tong A. Patients' Perspectives on Access to Dialysis and Kidney Transplantation in Rural Communities in Australia. *Kidney Int Rep*. 2021;7: 591–600. doi:10.1016/j.ekir.2021.11.010

46. Sainsbury E, Shi Y, Flack J, Colagiuri S. Burden of diabetes in Australia: It's time for more action. Sydney: University of Sydney; 2018 Jul.
47. National Association of Diabetes Centres. In: National Association of Diabetes Centres [Internet]. [cited 15 Feb 2024]. Available: <https://nadc.net.au/about-nadc/>
48. Lazzarini PA, van Netten JJ, Fitridge RA, Griffiths I, Kinnear EM, Malone M, et al. Pathway to ending avoidable diabetes-related amputations in Australia. *Med J Aust.* 2018;209: 288–290. doi:10.5694/mja17.01198
49. HRFS Accreditation. In: National Association of Diabetes Centres [Internet]. [cited 15 Feb 2024]. Available: <https://nadc.net.au/hrfs-accreditation/>
50. Lin R, Brown F, James S, Jones J, Ekinici E. Continuous glucose monitoring: A review of the evidence in type 1 and 2 diabetes mellitus. *Diabet Med.* 2021;38: e14528. doi:10.1111/dme.14528
51. Therapeutic Goods Administration (TGA). About the Ozempic (semaglutide) shortage 2022 and 2023 | Therapeutic Goods Administration (TGA). Therapeutic Goods Administration (TGA); 8 Dec 2022 [cited 1 Dec 2023]. Available: <https://www.tga.gov.au/safety/shortages/information-about-major-medicine-shortages/about-ozempic-semaglutide-shortage-2022-and-2023>
52. Lindekilde N, Scheuer SH, Rutters F, Knudsen L, Lasgaard M, Rubin KH, et al. Prevalence of type 2 diabetes in psychiatric disorders: an umbrella review with meta-analysis of 245 observational studies from 32 systematic reviews. *Diabetologia.* 2022;65: 440–456. doi:10.1007/s00125-021-05609-x
53. Holt RIG. Association Between Antipsychotic Medication Use and Diabetes. *Curr Diab Rep.* 2019;19: 96. doi:10.1007/s11892-019-1220-8
54. Tomic D, Morton JI, Salim A, Lambert T, Magliano DJ, Shaw JE. Hospitalisation for mental health disorders in Australians with type 1 or type 2 diabetes. *Diabetes Res Clin Pract.* 2023;196: 110244. doi:10.1016/j.diabres.2023.110244
55. Speight J, Holmes-Truscott E, Scibilia R, Black T. Diabetes: Stigma, blame and shame. Canberra: Diabetes Australia; Available: https://headsuptdiabetes.com.au/wp-content/uploads/2021/07/DIAA0039-StigmaReport_17sp_20210711.pdf
56. Nanayakkara N, Nguyen H, Churilov L, Kong A, Pang N, Hart GK, et al. Inpatient HbA1c testing: a prospective observational study. *BMJ Open Diabetes Res Care.* 2015;3: e000113. doi:10.1136/bmjdr-2015-000113
57. McEwen LN, Karter AJ, Curb JD, Marrero DG, Crosson JC, Herman WH. Temporal trends in recording of diabetes on death certificates: results from Translating Research Into Action for Diabetes (TRIAD). *Diabetes Care.* 2011;34: 1529–1533. doi:10.2337/dc10-2312
58. Sypek MP, Dansie KB, Clayton P, Webster AC, McDonald S. Comparison of cause of death between Australian and New Zealand Dialysis and Transplant Registry and the Australian National Death Index. *Nephrol Carlton Vic.* 2019;24: 322–329. doi:10.1111/nep.13250
59. Lee CMY, Colagiuri R, Magliano DJ, Cameron AJ, Shaw J, Zimmet P, et al. The cost of diabetes in adults in Australia. *Diabetes Res Clin Pract.* 2013;99: 385–390. doi:10.1016/j.diabres.2012.12.002
60. Productivity impacts of diabetes. Deloitte Access Economics; 2014.
61. Magliano DJ, Martin VJ, Owen AJ, Zomer E, Liew D. The Productivity Burden of Diabetes at a Population Level. *Diabetes Care.* 2018;41: 979–984. doi:10.2337/dc17-2138
62. Juvenile Diabetes Research Foundation. Economic cost of type 1 diabetes in Australia. Juvenile Diabetes Research Foundation; p. 27. Available: https://jdrf.org.au/wp-content/uploads/2021/06/The-economic-cost-of-T1D.pdf?utm_source=pardot&utm_medium=email&utm_campaign=accenture_report_release&utm_content=first_sen_d_wide_audience_cash_header
63. Schofield D, Shrestha RN, Cunich MM, Passey ME, Veerman L, Tanton R, et al. The costs of diabetes among Australians aged 45–64 years from 2015 to 2030: projections of lost productive life years (PLYs), lost personal income, lost taxation revenue, extra welfare payments and lost gross domestic product from Health&WealthMOD2030. *BMJ Open.* 2017;7: e013158. doi:10.1136/bmjopen-2016-013158
64. Lewis M, Herron L-M, Chatfield MD, Tan RC, Dale A, Nash S, et al. Healthy Food Prices Increased More Than the Prices of Unhealthy Options during the COVID-19 Pandemic and Concurrent Challenges to the Food System. *Int J Environ Res Public Health.* 2023;20: 3146. doi:10.3390/ijerph20043146
65. McGurnaghan SJ, Weir A, Bishop J, Kennedy S, Blackbourn LAK, McAllister DA, et al. Risks of and risk factors for COVID-19 disease in people with diabetes: a cohort study of the total population of Scotland. *Lancet Diabetes Endocrinol.* 2021;9: 82–93. doi:10.1016/S2213-8587(20)30405-8
66. Australian Bureau of Statistics. National Aboriginal and Torres Strait Islander Health Survey, 2018-19. 11 Dec 2019 [cited 30 Nov 2023]. Available: <https://www.abs.gov.au/statistics/people/aboriginal-and-torres-strait-islander-peoples/national-aboriginal-and-torres-strait-islander-health-survey/latest-release>
67. Hare MJL, Zhao Y, Guthridge S, Burgess P, Barr ELM, Ellis E, et al. Prevalence and incidence of diabetes among Aboriginal people in remote communities of the Northern Territory, Australia: a retrospective, longitudinal data-linkage study. *BMJ Open.* 2022;12: e059716. doi:10.1136/bmjopen-2021-059716

68. Titmuss A, Davis EA, O'Donnell V, Wenitong M, Maple-Brown LJ, Haynes A, et al. Youth-onset type 2 diabetes among First Nations young people in northern Australia: a retrospective, cross-sectional study. *Lancet Diabetes Endocrinol.* 2022;10: 11–13. doi:10.1016/S2213-8587(21)00286-2
69. Hare MJL, Barzi F, Boyle JA, Guthridge S, Dyck RF, Barr ELM, et al. Diabetes during pregnancy and birthweight trends among Aboriginal and non-Aboriginal people in the Northern Territory of Australia over 30 years. *Lancet Reg Health West Pac.* 2020;1: 100005. doi:10.1016/j.lanwpc.2020.100005
70. Lowe WL, Scholtens DM, Kuang A, Linder B, Lawrence JM, Lebenthal Y, et al. Hyperglycemia and Adverse Pregnancy Outcome Follow-up Study (HAPO FUS): Maternal Gestational Diabetes Mellitus and Childhood Glucose Metabolism. *Diabetes Care.* 2019;42: 372–380. doi:10.2337/dc18-1646
71. Lowe WL, Scholtens DM, Lowe LP, Kuang A, Nodzinski M, Talbot O, et al. Association of Gestational Diabetes With Maternal Disorders of Glucose Metabolism and Childhood Adiposity. *JAMA.* 2018;320: 1005–1016. doi:10.1001/jama.2018.11628
72. Disparities in potentially preventable hospitalisations across Australia, 2012–13 to 2017–18. Canberra: Australian Institute of Health and Welfare; 2020 p. 105. Available: <https://www.aihw.gov.au/getmedia/20bc5bf9-d46c-40a7-96c1-d632a1d448bc/aihw-hpf-50.pdf?v=20230605173952&inline=true>
73. Stuart L, Kimmel L, Jolly A, Stuart L, Kimmel L, Jolly A. Incidence of lower limb amputation in Central Australia. *Aust Health Rev.* 2021;45: 361–367. doi:10.1071/AH20182
74. Hoy WE, Mott SA, Mc Donald SP. An expanded nationwide view of chronic kidney disease in Aboriginal Australians. *Nephrol Carlton Vic.* 2016;21: 916–922. doi:10.1111/nep.12798
75. Australian Bureau of Statistics. Causes of death. 28 Sep 2023 [cited 30 Sep 2023]. Available: <https://www.abs.gov.au/statistics/health/causes-death>
76. Agarwal S, Wade AN, Mbanya JC, Yajnik C, Thomas N, Egede LE, et al. The role of structural racism and geographical inequity in diabetes outcomes. *The Lancet.* 2023;402: 235–249. doi:10.1016/S0140-6736(23)00909-1
77. Wood AJ, Graham S, Boyle JA, Marcusson-Rababi B, Anderson S, Connors C, et al. Incorporating Aboriginal women's voices in improving care and reducing risk for women with diabetes in pregnancy - A phenomenological study. *BMC Pregnancy Childbirth.* 2021;21: 624. doi:10.1186/s12884-021-04055-2
78. Weaver E, Freeman N, Mack S, Titmuss A, Dowler J, Corpus S, et al. "I Don't Really Know What Diabetes Is": A Qualitative Study Exploring the Experiences of Aboriginal and Torres Strait Islander Young People Aged 10 to 25 Years Living With Type 2 Diabetes in Northern and Central Australia. *Can J Diabetes.* 2022;46: 722–729. doi:10.1016/j.jcjd.2022.04.010
79. Taylor S, Fatima Y, Solomon S. Factors affecting the self-monitoring of blood glucose levels in Aboriginal patients: findings from a remote community. *Aust Indig Heal.* 2017;17.
80. Bruce DG, Davis WA, Cull CA, Davis TME. Diabetes education and knowledge in patients with type 2 diabetes from the community: the Fremantle Diabetes Study. *J Diabetes Complications.* 2003;17: 82–89. doi:10.1016/s1056-8727(02)00191-5
81. Position Statement: Gestational diabetes in Australia. Diabetes Australia; p. 10. Available: <https://diabetesaustralia.com.au/wp-content/uploads/Gestational-Diabetes-in-Australia-Position-Statement-2020.pdf>
82. Vohr BR, Boney CM. Gestational diabetes: The forerunner for the development of maternal and childhood obesity and metabolic syndrome? *J Matern Fetal Neonatal Med.* 2008;21: 149–157. doi:10.1080/14767050801929430
83. Macintosh MCM, Fleming KM, Bailey JA, Doyle P, Modder J, Acolet D, et al. Perinatal mortality and congenital anomalies in babies of women with type 1 or type 2 diabetes in England, Wales, and Northern Ireland: population based study. *BMJ.* 2006;333: 177. doi:10.1136/bmj.38856.692986.AE
84. Seah J-M, Kam NM, Wong L, Tanner C, Shub A, Houlihan C, et al. Risk factors for pregnancy outcomes in Type 1 and Type 2 diabetes. *Intern Med J.* 2021;51: 78–86. doi:10.1111/imj.14840
85. Wahabi HA, Fayed A, Esmail S, Elmorshedy H, Titi MA, Amer YS, et al. Systematic review and meta-analysis of the effectiveness of pre-pregnancy care for women with diabetes for improving maternal and perinatal outcomes. *PLoS One.* 2020;15: e0237571. doi:10.1371/journal.pone.0237571
86. Cook SJ, Phelps LA, Kwan M. Pregnancy outcomes for rural women with gestational diabetes: A retrospective audit. Society of Obstetric Medicine of Australia and New Zealand and Australasian Diabetes in Pregnancy Society Joint Scientific Meeting; 2017 Nov 20; Canberra. Available: <https://adips-somanz-2017.p.asnevents.com.au/days/2017-10-20/abstract/47223>
87. Chronic health conditions among culturally and linguistically diverse Australians, 2021. Australian Institute of Health and Welfare; 2023 Feb p. 26. Available: <https://www.aihw.gov.au/reports-data/population-groups/cald-australians/overview>

88. Thow AM, Waters, Anne-Marie. Diabetes in culturally and linguistically diverse Australians. Canberra: Australian Institute of Health and Welfare; 2005 Oct p. 72. Available: <https://www.aihw.gov.au/getmedia/ebe47968-5b5a-47fe-bb7c-2f695770e7d8/dclida.pdf?v=20230605170503&inline=true>
89. Colagiuri R, Thomas M, Buckley A. Preventing Type 2 Diabetes in Culturally and Linguistically Diverse Communities in NSW. Sydney: NSW Department of Health; 2007 p. 56. Available: <https://www.diabetesaustralia.com.au/wp-content/uploads/Preventing-Type-2-Diabetes-in-Culturally-and-Linguistically-Diverse-Communities-in-NSW.pdf>
90. Khatri RB, Assefa Y. Access to health services among culturally and linguistically diverse populations in the Australian universal health care system: issues and challenges. *BMC Public Health*. 2022;22: 880. doi:10.1186/s12889-022-13256-z
91. Social determinants of health snapshot. In: Australian Institute of Health and Welfare [Internet]. 7 Jul 2022 [cited 30 Nov 2023]. Available: <https://www.aihw.gov.au/reports/australias-health/social-determinants-of-health>
92. Disparities in potentially preventable hospitalisations across Australia: Exploring the data, About. In: Australian Institute of Health and Welfare [Internet]. 6 Feb 2020 [cited 30 Nov 2023]. Available: <https://www.aihw.gov.au/reports/primary-health-care/disparities-in-potentially-preventable-hospitalisa/contents/about>
93. Top line report: Diabetes National Community Consultation. Where To: Victoria. Diabetes Australia; 2023.
94. Morton JI, Ilomäki J, Magliano DJ, Shaw JE. The association of socioeconomic disadvantage and remoteness with receipt of type 2 diabetes medications in Australia: a nationwide registry study. *Diabetologia*. 2021;64: 349–360. doi:10.1007/s00125-020-05304-3
95. Zhao Y, Wakerman J, Zhang X, Wright J, VanBruggen M, Nasir R, et al. Remoteness, models of primary care and inequity: Medicare under-expenditure in the Northern Territory. *Aust Health Rev*. 2022;46: 302–308. doi:10.1071/AH21276
96. Aged care for Indigenous Australians. Australian Institute of Health and Welfare; Available: <https://www.aihw.gov.au/reports/australias-welfare/aged-care-for-indigenous-australians>
97. Morton JI, Lazzarini PA, Shaw JE, Magliano DJ. Trends in the Incidence of Hospitalization for Major Diabetes-Related Complications in People With Type 1 and Type 2 Diabetes in Australia, 2010–2019. *Diabetes Care*. 2022;45: 789–797. doi:10.2337/dc21-2268
98. Australia to 2050: Future Challenges. Canberra: Australian Government; 2010 p. 26.
99. Misra S, Ke C, Srinivasan S, Goyal A, Nyriyenda MJ, Florez JC, et al. Current insights and emerging trends in early-onset type 2 diabetes. *Lancet Diabetes Endocrinol*. 2023; S2213-8587(23)00225-5. doi:10.1016/S2213-8587(23)00225-5
100. Magliano DJ, Sacre JW, Harding JL, Gregg EW, Zimmet PZ, Shaw JE. Young-onset type 2 diabetes mellitus — implications for morbidity and mortality. *Nat Rev Endocrinol*. 2020;16: 321–331. doi:10.1038/s41574-020-0334-z
101. Wong J, Ross GP, Zoungas S, Craig ME, Davis EA, Donaghue KC, et al. Management of type 2 diabetes in young adults aged 18–30 years: ADS/ADEA/APEG consensus statement. *Med J Aust*. 2022;216. Available: <https://www.mja.com.au/journal/2022/216/8/management-type-2-diabetes-young-adults-aged-18-30-years-adsadeaapeg-consensus>
102. Ude AO, Baca TCD, Dixon SA, Arboine S-A, Terry NL, Chung ST. Transitioning care in youth-onset type 1 and type 2 diabetes: a scoping review protocol using the socio-ecological model framework. *BMJ Open*. 2022;12: e064186. doi:10.1136/bmjopen-2022-064186
103. Garvey KC, Markowitz JT, Laffel LMB. Transition to Adult Care for Youth with Type 1 Diabetes. *Curr Diab Rep*. 2012;12: 533–541. doi:10.1007/s11892-012-0311-6
104. Australian National Diabetes Strategy 2021–2030. Canberra: Australian Government; p. 44. Available: https://www.health.gov.au/sites/default/files/documents/2021/11/australian-national-diabetes-strategy-2021-2030_0.pdf
105. Parliament of Australia. Inquiry into Diabetes. [cited 30 May 2024]. Available: https://www.aph.gov.au/Parliamentary_Business/Committees/House/Health_Aged_Care_and_Sport/Inquiry_into_Diabetes
106. Tuomilehto J, Lindström J, Eriksson JG, Valle TT, Hämäläinen H, Ilanne-Parikka P, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med*. 2001;344: 1343–1350. doi:10.1056/NEJM200105033441801
107. Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med*. 2002;346: 393–403. doi:10.1056/NEJMoa012512
108. An Y, Zhang P, Wang J, Gong Q, Gregg EW, Yang W, et al. Cardiovascular and All-Cause Mortality Over a 23-Year Period Among Chinese With Newly Diagnosed Diabetes in the Da Qing IGT and Diabetes Study. *Diabetes Care*. 2015;38: 1365–1371. doi:10.2337/dc14-2498
109. Australian Bureau of Statistics. Australian Health Survey: Consumption of Added Sugars. Australia. 2011–12. Canberra: ABS; 2016 Apr p. 36.

110. Australian Medical Association. A tax on sugar-sweetened beverages: Modelled impacts on sugar consumption and government revenue. Barton: AMA; 2021 Jun p. 42.
111. Nicholas L, Roberts DCK, Pond D. The role of the general practitioner and the dietitian in patient nutrition management. *Asia Pac J Clin Nutr*. 2003;12: 3–8.
112. Siopis G, Colagiuri S, Allman-Farinelli M. Dietitians' experiences and perspectives regarding access to and delivery of dietetic services for people with type 2 diabetes mellitus. *Heliyon*. 2020;6: e03344. doi:10.1016/j.heliyon.2020.e03344
113. Sadiya A, Jakapure V, Shaar G, Adnan R, Tesfa Y. Lifestyle intervention in early pregnancy can prevent gestational diabetes in high-risk pregnant women in the UAE: a randomized controlled trial. *BMC Pregnancy Childbirth*. 2022;22: 668. doi:10.1186/s12884-022-04972-w
114. Gibson O, Lisy K, Davy C, Aromataris E, Kite E, Lockwood C, et al. Enablers and barriers to the implementation of primary health care interventions for Indigenous people with chronic diseases: a systematic review. *Implement Sci*. 2015;10: 71. doi:10.1186/s13012-015-0261-x
115. Nguyen HD, Chitturi S, Maple-Brown LJ. Management of diabetes in Indigenous communities: lessons from the Australian Aboriginal population. *Intern Med J*. 2016;46: 1252–1259. doi:10.1111/imj.13123
116. Tremblay M-C, Graham J, Porgo TV, Dogba MJ, Paquette J-S, Careau E, et al. Improving Cultural Safety of Diabetes Care in Indigenous Populations of Canada, Australia, New Zealand and the United States: A Systematic Rapid Review. *Can J Diabetes*. 2020;44: 670–678. doi:10.1016/j.jcjd.2019.11.006
117. Porta M, Curletto G, Cipullo D, Rigault de la Longrais R, Trento M, Passera P, et al. Estimating the delay between onset and diagnosis of type 2 diabetes from the time course of retinopathy prevalence. *Diabetes Care*. 2014;37: 1668–1674. doi:10.2337/dc13-2101
118. Harris MI, Klein R, Welborn TA, Knudman MW. Onset of NIDDM occurs at least 4-7 yr before clinical diagnosis. *Diabetes Care*. 1992;15: 815–819. doi:10.2337/diacare.15.7.815
119. Medical Services Advisory Committee. 1677 – Pharmacy Diabetes Screening Trial. Australian Government Department of Health; 2021. Available: <http://www.msac.gov.au/internet/msac/publishing.nsf/Content/1677-public>
120. RACGP. RACGP submission to the Inquiry into Diabetes in Australia. Melbourne: Royal Australian College of General Practitioners; 2023 Sep p. 14.
121. Zarora R, Immanuel J, Chivese T, MacMillan F, Simmons D. Effectiveness of Integrated Diabetes Care Interventions Involving Diabetes Specialists Working in Primary and Community Care Settings: A Systematic Review and Meta-Analysis. *Int J Integr Care*. 2022;22: 11. doi:10.5334/ijic.6025
122. Western Sydney Diabetes. In: Western Sydney Diabetes [Internet]. [cited 15 Feb 2024]. Available: <https://westernsydneydiabetes.com.au/>
123. Diabetes remission. In: Diabetes UK [Internet]. [cited 30 Nov 2023]. Available: <https://www.diabetes.org.uk/guide-to-diabetes/managing-your-diabetes/treating-your-diabetes/type2-diabetes-remission>
124. Riddle MC, Cefalu WT, Evans PH, Gerstein HC, Nauck MA, Oh WK, et al. Consensus Report: Definition and Interpretation of Remission in Type 2 Diabetes. *Diabetes Care*. 2021;44: 2438–2444. doi:10.2337/dci21-0034
125. Australian Diabetes Educators Association. ADEA 2023 Member Survey. Woden: ADEA; 2023.
126. Australian Diabetes Society, Australian Diabetes Educators Association. 2021 ADS-ADEA Technology Member Survey. Sydney: Australian Diabetes Society; 2021.
127. Meyerowitz-Katz G, Seelan S, Gaur P, Francisco R, Ferdousi S, Astell-Burt T, et al. Detecting the hidden burden of pre-diabetes and diabetes in Western Sydney. *Diabetes Res Clin Pract*. 2019;151: 247–251. doi:10.1016/j.diabres.2019.04.019
128. Immanuel J, Flack J, Wong VW, Yuen L, et al. The ADIPS Pilot National Diabetes in Pregnancy Benchmarking Programme. *Int J Environ Res Public Health*. 2021 May 4;18(9):4899. doi: 10.3390/ijerph18094899. PMID: 34064492; PMCID: PMC8125192.
129. Nguyen A, Akhter, R, Garde S, et al. The Association of Periodontal Disease with the complications of diabetes mellitus. A systematic review. *Diabetes Research and Clinical Practice*. 2020 July DOI: 10.1016/j.diabres.2020.108244. PMID: 32526263
130. Diabetes in Hospital: Healthcare providers' guide to Diabetes Management for Inpatients. NDSS. July 2022. Available: <https://www.ndss.com.au/wp-content/uploads/booklet-hp-guide-diabetes-in-hospital.pdf>
131. Diabetes hospitalisations in Australia, 2003-04. AIHW. [Internet] 30 Aug 2006. [cited 14 Jun 2024] <https://www.aihw.gov.au/reports/diabetes/diabetes-hospitalisations-australia-2003-04/contents/summary>

Diabetes Australia acknowledges the valuable contributions to this report from members of the Expert Reference Group:

Professor Sof Andrikopoulos
Anna Blackie
Professor Alex Brown
Ann Bush
Susan Davidson
Professor Elizabeth Davis
Professor Elif Ekinci
Professor Josephine Forbes

Dr Konrad Kangru
Professor Dianna Magliano OAM
Professor Louise Maple-Brown
Melanie Morris
Professor Anthony Russell
Professor Jonathan Shaw
Professor David Simmons
Professor Stephen Twigg

Diabetes Australia recognises the generous support of our partner organisations, none of which have contributed to the content.

Eli Lilly and Company (Lilly) is a global healthcare leader that unites caring with discovery to create medicines that make life better for people around the world. Harnessing the power of biotechnology, chemistry and genetic medicine, Lilly's scientists are urgently advancing new discoveries to solve some of the world's most significant health challenges. Lilly has been a global leader in diabetes care since 1923, when they introduced the world's first commercial insulin. Today they are building upon this heritage by working to meet the diverse needs of people with diabetes and those who care for them. Through research and collaboration, Lilly strives to make life better for people impacted by diabetes.

Novo Nordisk is a leading global healthcare company, founded in 1923 and headquartered in Denmark. Our purpose is to drive change to defeat diabetes and other serious chronic diseases such as obesity and rare blood and endocrine disorders.

Diabetes Australia

Phone: +61 2 6232 3800

Fax: +61 2 6230 1535

E-mail: admin@diabetesaustralia.com.au

Website: diabetesaustralia.com.au

