



Utilisation, access and recommendations regarding technologies for people living with type 1 diabetes: consensus statement of the ADS/ADEA/APEG/ADIPS Working Group

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Despite developments in diabetes care, people with type 1 diabetes still experience the debilitating impact of glycaemic fluctuations and a disproportionately high risk of vascular and pregnancy-related complications.¹⁻⁶ Therefore, the continued advancement of diabetes management technologies has a major role in the efforts to reduce the impact and economic cost of the disease on people with type 1 diabetes and on health care systems.

The high acquisition cost of diabetes management technologies remains a key barrier to equitable access for people living with type 1 diabetes.⁷⁻⁹ Despite government funding initiatives that improve access for some groups, diabetes management technologies appear to be underutilised overall. It was estimated in 2020 that about 21% of people with type 1 diabetes used insulin pumps across the lifespan in Australia (unpublished data). Furthermore, it was reported that 80% of pump users in Australia obtained their device via private health insurance and about twice as many pump users were living in areas of high socio-economic status compared with low socio-economic status areas.^{10,11} Comparable to utilisation data from other developed countries, the Australian National Diabetes Audit (ANDA) reported in 2019 that continuous glucose monitoring was used by 23% of adults and 62% of young people at participating centres across Australia.^{12,13}

Through the National Diabetes Services Scheme (NDSS), the Australian Government commenced subsidisation of continuous glucose monitoring in April 2017 for people with type 1 diabetes under 21 years of age who meet the eligibility criteria.¹⁴ The Continuous Glucose Monitoring (CGM) Initiative was later extended to include some adults with type 1 diabetes, such as those with concessional status or people of Aboriginal or Torres Strait Islander origin, as well as to women who were planning a pregnancy, were pregnant or immediately after pregnancy (< 3 months).¹⁴ While these funding strategies assist some groups, they do not facilitate access to interstitial glucose sensors for the majority of adults without concessional status. Furthermore, access to insulin pump therapy in Australia remains almost entirely restricted to those with Gold or Silver tiers of private health insurance (hospital cover).¹⁵

In addition to ongoing advocacy for greater access to devices for people with type 1 diabetes, it is important to highlight the increasing workload that diabetes management technologies have on health care systems. Reports from current generation insulin pumps and continuous glucose monitoring/flash glucose monitoring provide large volumes of complex data but do not currently have specific Medicare Benefits Schedule item numbers to remunerate health care professionals for the significant

Abstract

Introduction: Type 1 diabetes presents significant challenges for optimal management. Despite intensive glycaemic control being the standard of care for several decades, glycaemic targets are infrequently achieved and the burden of complications remains high. Therefore, the advancement of diabetes management technologies has a major role in reducing the clinical and economic impact of the disease on people living with type 1 diabetes and on health care systems. However, a national framework is needed to ensure equitable and sustainable implementation of these technologies as part of holistic care.

Main recommendations: This consensus statement considers technologies for insulin delivery, glucose sensing and insulin dose advice that are commercially available in Australia. While international position statements have provided recommendations for technology implementation, the ADS/ADEA/APEG/ADIPS Working Group believes that focus needs to shift from strict trial-based glycaemic criteria towards engagement and individualised management goals that consider the broad spectrum of benefits offered by technologies.

Changes in management as result of this statement: This Australian consensus statement from peak national bodies for the management of diabetes across the lifespan outlines a national framework for the optimal implementation of technologies for people with type 1 diabetes. The Working Group highlights issues regarding equity of access to technologies and services, scope of clinical practice, credentialling and accreditation requirements, regulatory issues with “do-it-yourself” technology, national benchmarking, safety reporting, and ongoing patient advocacy.

amount of additional time required to interpret them or alter management. The degree of expertise required of health care professionals to manage these technologies also warrants further consideration of their scope of practice and credentialling as well as accreditation for service providers.

This consensus statement thus highlights the inequity of access and barriers to optimal implementation of technology, and provides consensus recommendations to improve health care for people living with type 1 diabetes in Australia. The full version of the consensus statement is available at <https://diabetessociety.com.au/position-statements.asp>.

Methods

Members of the Working Group comprised key stakeholders, including people with type 1 diabetes and representatives of multiple national bodies involved in the management of diabetes — the Australian Diabetes Society (ADS), the Australian Diabetes

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Educators Association (ADEA), the Australasian Paediatric Endocrine Group (APEG) and the Australasian Diabetes in Pregnancy Society (ADIPS) ([Supporting Information](#)). Meetings over 2019–2021 and collaborative drafting processes led to consensus recommendations based on expert opinion and therefore have very low certainty of evidence according to the GRADE framework. It is expected that the consensus statement will be read in conjunction with the Australian living evidence guidelines in diabetes for continually updated evidence-based recommendations regarding the comparative efficacy of technologies.¹⁶

Diabetes management technologies and consensus recommendations for use

Insulin delivery

Management of type 1 diabetes requires basal insulin as well as intermittent rapid-acting insulin boluses for meals and correction of hyperglycaemia. Continuous subcutaneous insulin infusion is an alternative to multiple daily injections and comprises a portable, battery-operated device that pumps insulin to the subcutaneous tissue via an infusion set (or tubeless system for patch pumps).¹⁷ Comprehensive discussions regarding continuous subcutaneous insulin infusion therapy and the different available pumps are important because these devices require additional education, accurate carbohydrate counting, and the capacity to manage reasonably complex troubleshooting for the device and data-uploading processes.^{18,19} The consensus recommendations for insulin pump therapy are presented in [Box 1](#).

Glucose monitoring

People living with type 1 diabetes must regularly monitor glucose levels to make self-management decisions. Self-monitoring of capillary blood glucose requires multiple finger prick checks at discrete time points before and after meals and activity.⁷ Interstitial glucose monitoring technologies continue to evolve, with different sensors currently able to provide one to two weeks of real-time or intermittently scanned (ie, flash glucose monitoring) continuous glucose measurements before requiring replacement.²⁰

Current evidence suggests that the proportion of time using interstitial glucose monitoring correlates with the degree of glycaemic

benefit.^{7,21–23} Furthermore, the interpretation of reports from interstitial glucose monitoring requires detailed discussions between health care professionals and people living with type 1 diabetes to correlate multiple potential contributing factors with observed glucose levels and tailored advice regarding insulin, diet and other lifestyle measures. [Box 2](#) shows the consensus recommendations for the use of technologies for glucose monitoring.

Technology for insulin dose advice

Optimal education for people with type 1 diabetes is comprehensive and needs to be tailored to the individual's age and learning level, involving carers as required. Individualised education should include carbohydrate counting as well as training for insulin dose adjustment according to current glucose levels, previous insulin doses, diet, and physical activity.²⁴ The most commonly used technologies for insulin dose advice include insulin pumps with built-in calculators, free-standing insulin dose advisors, and applications for smart devices. Applications for smart devices offer a portable solution within a device that does not carry the perceived stigma that may exist for some medical devices.²⁵ However, not all applications have been assessed or approved by professional or regulatory bodies and therefore require more cautious consideration.²⁶ The consensus recommendations regarding insulin dose advisors are described in [Box 3](#).

Integrated insulin pumps and continuous glucose monitoring systems

Insulin pumps may be integrated with continuous glucose monitoring systems to facilitate varying levels of automation for insulin delivery. In some systems, basal insulin delivery is suspended when a low glucose threshold is reached or predicted to be reached in the near future to reduce the burden of hypoglycaemia.^{27,28} Hybrid closed-loop systems have been developed more recently and appear to provide the best potential for glycaemic outcomes due to the dual capabilities of increasing basal insulin

1 Stand-alone insulin pump therapy: key messages

Willingness and engagement should be key in deciding to start or continue stand-alone CSII

Consider stand-alone CSII therapy especially if:

- There are realistic expectations regarding benefits of CSII therapy
- Individualised diabetes management goals (especially HbA_{1c} levels) are not achieved despite intensive management with other interventions
- Planning pregnancy and individualised diabetes management goals (especially HbA_{1c} levels) are not achieved

Consider avoiding CSII therapy if:

- The person with type 1 diabetes considers that real or perceived disadvantages of CSII outweigh benefits after discussions with health care professionals
- Safe use of CSII cannot be ensured following concerted efforts with additional education by a multidisciplinary team of experienced health care professionals

CSII = continuous subcutaneous insulin infusion; HbA_{1c} = glycated haemoglobin. Given the sparsity of evidence regarding the optimal approach to implementation and funding of CSII from a public health perspective, the consensus recommendations were based on expert opinion and, therefore, have very low certainty of evidence according to the GRADE framework. Source: Reproduced from <https://diabetessociety.com.au/position-statements.asp>, with permission. ♦

2 Glucose monitoring: key messages

Willingness and engagement should be key in deciding to start or continue continuous glucose monitoring/flash glucose monitoring

Consider continuous glucose monitoring/flash glucose monitoring therapy especially if:

- There are realistic expectations regarding benefits of continuous glucose monitoring/flash glucose monitoring
- Individualised diabetes management goals are not achieved despite intensive management with other interventions (especially frequent hypoglycaemia)
- There is frequent and/or severe hypoglycaemia or impaired awareness of hypoglycaemia (continuous glucose monitoring may be preferred)
- Remote monitoring of real-time glucose levels is required (continuous glucose monitoring may be preferred)
- Planning pregnancy

Consider avoiding continuous glucose monitoring/flash glucose monitoring if:

- The person with type 1 diabetes considers that real or perceived disadvantages of continuous glucose monitoring/flash glucose monitoring outweigh benefits after discussions with health care professionals
- Appropriate* use of continuous glucose monitoring/flash glucose monitoring cannot be ensured following concerted efforts with additional education by a multidisciplinary team of experienced health care professionals

* The definition of appropriate use of continuous glucose monitoring/flash glucose monitoring may be individualised but reflects frequency of use, changes to insulin therapy based on the available data, upload of data for review by health care professionals, and use of devices in accordance with manufacturer recommendations. Source: Reproduced from <https://diabetessociety.com.au/position-statements.asp>, with permission. ♦

3 Insulin dose advisors: key messages

All people living with type 1 diabetes who titrate insulin therapy may benefit from insulin dose advisors

Consider avoiding insulin dose advisors if:

- The person with type 1 diabetes considers that real or perceived disadvantages of insulin dose advisors outweigh benefits after discussions with health care professionals
- Appropriate* use of insulin dose advisors cannot be ensured following concerted efforts with additional education by a multidisciplinary team of experienced health care professionals

* The definition of appropriate use of insulin dose advisors may be individualised but reflects the ability to quantify carbohydrate content, changes to insulin therapy based on the available data, upload/provision of data for review by health care professionals, and the use of approved insulin dose advisors. Given the sparsity of evidence regarding the optimal approach to implementation of insulin dose advisors from a public health perspective, the consensus recommendations were based on expert opinion and, therefore, have very low certainty of evidence according to the GRADE framework. Source: Reproduced from <https://diabetessociety.com.au/position-statements.asp>, with permission. ♦

delivery to mitigate hyperglycaemia and decreasing basal insulin delivery to reduce the burden of hypoglycaemia.²⁹⁻³⁶

Limitations of integrated insulin pumps and continuous glucose monitoring include financial cost, sensor failures, capillary calibration checks, being attached to multiple devices, the need for manual boluses, and potential alarm fatigue.³⁷⁻³⁹ In addition, commercially available hybrid closed-loop systems are not recommended for use in pregnancy or young children.^{39,40}

At the time of writing, the only available hybrid closed-loop system in Australia was the MiniMed 670G (Medtronic).⁴⁰ Supporting their use, hybrid closed-loop systems have recently been reported as relatively cost-effective compared with multiple daily injections with capillary glucose testing among adults in the Australian context.⁴¹ Box 4 outlines the consensus recommendations for the use of integrated insulin pump and continuous glucose monitoring systems.

“Do-it-yourself” technology and regulatory issues

The Working Group does not endorse the use of any technology unless approved by the Therapeutic Goods Administration and

4 Integrated continuous subcutaneous insulin infusion (CSII) and continuous glucose monitoring systems: key messages

Willingness and engagement should be key in deciding to start or continue integrated systems

Consider integrated systems (usually hybrid closed-loop systems) especially if:

- There are realistic expectations regarding benefits
- Individualised diabetes management goals are not achieved (especially HbA_{1c} level, time in range, or hypoglycaemia) despite intensive management with other methods
- The burden of other approaches to intensive self-management has a significant detrimental impact on quality of life

Consider avoiding integrated systems if:

- The person with type 1 diabetes considers that real or perceived disadvantages of integrated systems outweigh benefits after discussions with health care professionals
- Safe use of integrated systems cannot be ensured following concerted efforts with additional education by a multidisciplinary team of experienced health care professionals

HbA_{1c} = glycated haemoglobin. Given the sparsity of evidence regarding the optimal approach to implementation and funding of integrated CSII and continuous glucose monitoring systems from a public health perspective, consensus recommendations were based on expert opinion and, therefore, have very low certainty of evidence according to the GRADE framework. Source: Reproduced from <https://diabetessociety.com.au/position-statements.asp>, with permission. ♦

used according to the manufacturers' instructions. However, all clinicians should be aware of unapproved devices or systems and be able to discuss the functionality and risks of using them.

Inequity of access to diabetes management technologies

Insulin pumps

The Australian Government's Insulin Pump Program is administered by the Juvenile Diabetes Research Foundation and provides a means-tested subsidy for the cost of an insulin pump.^{8,11} However, the program is restricted to a proportion of people with type 1 diabetes under the age of 18 years (~220 per year following the 2018–19 Budget) who meet the eligibility criteria.¹¹

Among the adult population and young people without subsidised access, insulin pumps require private health insurance; alternatively, individuals may completely self-fund (\$6994–\$8574 per device).⁴² The highest tier private health insurance policies (Gold with hospital cover) will reimburse for insulin pumps on an unrestricted basis, and some funds may also choose to provide insulin pumps with lower tiers of cover.⁴³ However, apart from Gold tier policies, the Working Group is only aware of a limited number of Silver and Bronze policies that offer insulin pumps as additional clinical categories.

Restricted compassionate access pathways for insulin pumps also highlight the limitations of current funding systems, are not usually widely advertised, and may further disadvantage patients in rural and remote areas without access to tertiary centres or health care professionals familiar with these access pathways.

Glucose monitoring

In Australia, continuous glucose monitoring is broadly subsidised for young people under 21 years of age and is fully subsidised for children aged under 10 years.⁴⁴ However, not all interstitial glucose sensors are indicated for use in all age groups or conditions. The eligibility criteria for young people between 11 and 21 years of age are outlined on the NDSS website.⁴⁴

The CGM Initiative was extended from March 2019 to include people with type 1 diabetes of all ages who were considered to have the highest clinical need, comprising:¹⁴

- children and young people with conditions very similar to type 1 diabetes, such as cystic fibrosis-related diabetes and neonatal diabetes, who require insulin;
- women with type 1 diabetes who are actively planning a pregnancy (< 12 months), pregnant, or immediately after pregnancy (< 3 months); and
- people with type 1 diabetes over 21 years of age with concessional status or of Aboriginal or Torres Strait Islander origin and who have a high clinical need to access continuous glucose monitoring products.

The CGM Initiative was further extended from March 2020 to include flash glucose monitoring. Eligibility criteria were also expanded to adults over 21 years of age with concessional status or of Aboriginal or Torres Strait Islander origin without the requirement of “high clinical need”.⁴⁵

While the CGM Initiative greatly assists some groups, it does not facilitate equitable access to interstitial glucose sensors, as most adults do not have concessional status. Furthermore, the CGM Initiative will negatively affect young people who do not retain concessional status once they reach 21 years of age and thus lose access to a vital self-management tool.

Technology for insulin dose advice

People with type 1 diabetes who are registered with the NDSS in Australia may acquire glucose meters with insulin dose advisor functionality without cost through health care professionals or other manufacturer-specific pathways.⁴⁶

Health care systems and barriers

The 2011 national evidence-based clinical care guidelines provide extensive insights into holistic care for people with type 1 diabetes.²⁴ However, the continually evolving landscape of management technologies requires further attention.

Comprehensive guidelines are also needed regarding the scope of practice for health care professionals as well as which health care professionals and services should be involved in commencing and monitoring diabetes management technologies across primary care, private practice (ie, private medical specialists and diabetes educators), and tertiary care settings. The extensive framework provided by the Australian National Adult Insulin Pump Therapy Working Group in 2013 remains relevant,⁴⁷ and the consensus statement Working Group intends to integrate updated technologies and broaden the scope across the lifespan and across the range of health care services. The approach to scope and scale of expertise for rural and regional areas also requires particular attention. The ideal would be to ensure experienced and ongoing health care professional oversight for all people with type 1 diabetes using diabetes management technology.

Consensus statement recommendations for technology use and implementation

Commencing diabetes management technologies

The Working Group believes that all people with type 1 diabetes should have equitable access to all technologies that assist in the optimal management of their condition, improve quality of life, and reduce the burden of self-management.

The Working Group also recommends establishing suitability criteria to determine which individuals with type 1 diabetes would derive particular benefit from diabetes management technologies. Rather than focusing on strict glycaemic thresholds to guide clinical or funding decisions, the Working Group emphasises that optimal glycaemic improvements are derived when people with type 1 diabetes actively engage with the device and health care professionals. The essential criteria for commencing technology and the criteria indicating that intensified therapy with technology may be of particular benefit are outlined in [Box 5](#).

Continuing diabetes management technologies

Due to limited resources, the Working Group proposed that there should also be criteria for continued use of diabetes management technologies. This has particular applicability in instances where the government is subsidising devices or related consumables, and provides an implementation framework for subsidisation of other technologies in the future.

The Working Group proposed that the focus of these criteria be on supporting all people living with type 1 diabetes while also recognising that diabetes management technology may not be necessary or appropriate for everybody. When there is concern about the ability or willingness of an individual living with type 1 diabetes to continue using diabetes management technology, a thorough assessment should consider contributing factors.

5 Consensus recommendations for commencing and continuing diabetes management technologies

Essential criteria for commencing technology:

- Willingness to use technology with realistic expectations of benefits and limitations
- Willingness to have regular contact with appropriate health care professionals/health care services
- Development of individualised diabetes management goals with an appropriate diabetes specialist who outlines the role of technology in reaching these goals
- Ability to count carbohydrate content for insulin delivery technologies

Criteria indicating that intensified therapy with technology may be of particular benefit:

- History of severe hypoglycaemia requiring third-party assistance
- Reduced ability to recognise or communicate symptoms of hypoglycaemia
- Fear of hypoglycaemia
- Poor quality of life relating to the impact of diabetes
- Glycaemic variability
- Frequent hospital presentations for dysglycaemia including hypoglycaemia or diabetic ketoacidosis
- Pregnancy or planning pregnancy
- Occupations incompatible with frequent finger prick checking (eg, health care professionals working in operating theatres, long distance and commercial drivers, professional and non-professional athletes, defence force, airline/air force personnel, police force, those working in hazardous environments where finger prick checking is not practicable)
- Meet the suitability criteria for islet or simultaneous pancreas/kidney transplantation, or previous islet transplantation but still requiring insulin
- Requirement for remote monitoring of glucose levels
- Needle phobia
- Insulin allergy

Essential criteria for continuing technology:

- Demonstration of the ability/willingness to continue using technology
- Demonstration of the ability/willingness to continue regular contact with health care professionals/services
- Demonstration of technology assisting the person with type 1 diabetes to reach individualised diabetes management goals
- Demonstration of an appropriate specialist commencing, reviewing progress, and signing off on continued use of diabetes management technology

Given the sparsity of evidence regarding the optimal implementation of diabetes management technologies and eligibility criteria for targeting its use, consensus recommendations were based on expert opinion and, therefore, have very low certainty of evidence according to the GRADE framework. Source: Adapted from <https://diabetessociety.com.au/position-statements.asp>, with permission. ♦

Multidisciplinary efforts should also be made to support and assist people with type 1 diabetes to engage with diabetes management technology and to individualise care to address concerns such as burnout, self-image, expectations, and other factors. In addition, the inclusion of individualised diabetes management goals is a recognition of the broad spectrum of benefits potentially offered by technology rather than the focus being limited to the achievement of strict glycaemic targets. Individualised goals may relate to quality of life, fear of hypoglycaemia, participation in healthy behaviour, and improved glycaemia among others. These individualised goals may also change following commencement of technologies.

Rather than applying punitive threshold criteria for the cessation of diabetes management technology, individualised management goals should allow the consideration of observed benefits and disadvantages to direct the most appropriate management strategy. The individual with type 1 diabetes should then be supported by their health care professionals to address any barriers to effective implementation of technology, choose a more suitable technology, or have a break from technology if appropriate. Health care professionals should also update people with type 1 diabetes who have chosen to have a break from

6 Key issues raised by the Working Group and a strategic framework for Australia

Equitable access to diabetes management technologies as well as appropriate education and health care service delivery

Members and organisations that formed the Working Group will:

- Advocate for increased access to insulin pump therapy for all people living with type 1 diabetes, especially those without access to private health insurance for whom intensified therapy with technology may be of particular benefit
- Advocate for further expansion of the Continuous Glucose Monitoring Initiative to provide access for all individuals with type 1 diabetes who meet the essential criteria for commencing technology
- Collaborate with relevant industry, political and other key stakeholders to develop a standardised framework for education provided by the diabetes technology industry that also includes digitally secure and transparent clinical record documentation

Appropriate funding for health care delivery that involves diabetes management technologies

Members of the Working Group intend to prepare submissions to the Australian Government that highlight the need to review existing Medicare Benefits Schedule (MBS) item numbers and develop new MBS item numbers for the evolving landscape of diabetes management technologies in order to appropriately support people with type 1 diabetes and ensure optimal use of devices to achieve the best possible outcomes

Expedited review of diabetes management technologies

- In the context of rapidly evolving technologies, the Working Group highlighted the need for streamlined government review and implementation processes that include health care professionals to avoid unnecessary delays in clinical access to diabetes management technologies. One approach to streamline Therapeutic Goods Administration approvals for diabetes management technologies could represent their inclusion in existing fast track approval pathways used for medications
- Members and organisations that formed the Working Group will continue to advocate for change and collaborate with all levels of government to ensure the fastest possible access to diabetes management technologies

Benchmarking and evaluation of the health care system

- A unified approach to health care delivery for diabetes management technology requires ongoing evaluation of performance and changes over time
- The Australian National Diabetes Audit (ANDA) and the Australasian Diabetes Data Network (ADDN) are existing frameworks that provide valuable data for benchmarking across centres as well as investigating the national and regional impact of technologies and policy change on clinical outcomes
- The expansion of current approaches will improve the generalisability of results, and the inclusion of standardised outcomes for technologies across both initiatives with a component of longitudinal follow-up will provide greater insights

Safety and adverse event reporting

- Adverse event reporting forms an integral part of ensuring safety for people with type 1 diabetes and should be part of the evaluation and benchmarking of devices and health care systems. However, the Working Group highlighted the current lack of a standardised system for reporting the full spectrum of adverse events related to diabetes management technologies
- Members and organisations that formed the Working Group will address adverse event reporting collaboratively with government, industry and other key stakeholders

Continues

6 Continued

Credentialing/accreditation for care providers and health care services

- Working Group representatives highlighted the need for a unified national approach to health care delivery for diabetes management technologies
- Integration of existing work by the National Association of Diabetes Centres (NADC) on accreditation as well as the Australian National Adult Insulin Pump Therapy Working Group on scope of practice will be foundational to more cohesive recommendations
- Members and organisations that formed the Working Group will develop training and credentialing standards to ensure best practice implementation of diabetes management technologies throughout Australia

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technology of any subsequent systems or new technologies that are developed and that may overcome previous barriers to effective implementation. The essential criteria for continuing technology are presented in [Box 5](#).

Strategic issues raised as part of the implementation framework in Australia

The overarching focus for the Working Group was the need for access to diabetes management technologies as well as a strategic implementation framework. Specific advocacy steps and collaborations within the Australian health care system are outlined in [Box 6](#).

Conclusion

The Working Group believes that all people with type 1 diabetes should have equitable access to the most effective management systems, including technology, where clinically appropriate, regardless of age, concessional status or level of private health insurance cover. This Australian consensus statement provides a unified implementation framework to ensure optimal utilisation of diabetes management technologies with international relevance. In addition to ongoing advocacy for greater access, the proposed implementation framework highlights the need for accreditation, credentialing and technology-specific funding initiatives for health care professionals to support the management of people with type 1 diabetes using technologies that generate large volumes of complex data. The Working Group also outlines the need for ongoing appraisal of implementation strategies, safety reporting, and funding initiatives to ensure sustainable health care and optimal outcomes for all people living with type 1 diabetes.

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- 1 International Diabetes Federation. IDF Diabetes Atlas, 7th ed, 2015, <https://www.diabetesatlas.org/upload/resources/previous/files/7/IDF%20Diabetes%20Atlas%207th.pdf> (viewed Apr 2021).
- 2 Diabetes Control and Complications Trial/ Epidemiology of Diabetes Interventions and

Complications (DCCT/EDIC) Research Group; Nathan DM, Zinman B, Cleary PA, et al. Modern-day clinical course of type 1 diabetes mellitus after 30 years' duration: the diabetes control and complications trial/epidemiology of diabetes interventions and complications and Pittsburgh epidemiology of diabetes complications

experience (1983–2005). *Arch Intern Med* 2009; 169: 1307–1316.

- 3 de Ferranti SD, de Boer IH, Fonseca V, et al. Type 1 diabetes mellitus and cardiovascular disease: a scientific statement from the American Heart Association and American Diabetes Association. *Diabetes Care* 2014; 37: 2843–2863.

- 4 Nathan DM; DCCT/EDIC Research Group. The diabetes control and complications trial/epidemiology of diabetes interventions and complications study at 30 years: overview. *Diabetes Care* 2014; 37: 9–16.
- 5 Diabetes Control and Complications Trial Research Group; Nathan DM, Genuth S, Lachin J, et al. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Engl J Med* 1993; 329: 977–986.
- 6 Australian Institute of Health and Welfare. Diabetes in pregnancy 2014–2015 [Cat. No. CDK 7]. Canberra: AIHW, 2019. <https://www.aihw.gov.au/reports/diabetes/diabetes-in-pregnancy-2014-2015/contents/summary> (viewed Apr 2021).
- 7 American Diabetes Association. Diabetes Technology: Standards of Medical Care in Diabetes — 2019. *Diabetes Care* 2019; 42: S71.
- 8 Diabetes Australia. Insulin pump therapy in Australia: the case for action. Canberra: Diabetes Australia, 2014. <https://static.diabetesaustralia.com.au/s/fileassets/diabetes-australia/71ae321b-fc80-46ea-8cea-09940d3a6977.pdf> (viewed June 2020).
- 9 Tanenbaum ML, Hanes SJ, Miller KM, et al. Diabetes device use in adults with type 1 diabetes: barriers to uptake and potential intervention targets. *Diabetes Care* 2017; 40: 181–187.
- 10 Australian Institute of Health and Welfare. Insulin pump use in Australia [Cat. No. CVD 58; Diabetes series No. 18]. Canberra: AIHW, 2012. <https://www.aihw.gov.au/getmedia/983a6c0e-55f2-465f-8bdb-d211704523a4/14454.pdf.aspx?inline=true> (viewed Apr 2021).
- 11 Juvenile Diabetes Research Foundation. Living with type 1 diabetes: Insulin Pump Program, 2019. <https://jdrf.org.au/living-with-t1-diabetes/insulin-pump-program> (viewed Nov 2019).
- 12 Pease A, Szwarcbard N, Earnest A, et al. Glycaemia and utilisation of technology across the lifespan of adults with type 1 diabetes: Results of the Australian National Diabetes Audit (ANDA). *Diabetes Res Clin Pract* 2021; 171: 108609.
- 13 Miller KM, Hermann J, Foster N, et al. Longitudinal changes in continuous glucose monitoring use among individuals with type 1 diabetes: international comparison in the German and Austrian DPV and US T1D Exchange Registries. *Diabetes Care* 2020; 43: e1–e2.
- 14 National Diabetes Services Scheme. Changes to the NDSS. <https://www.ndss.com.au/about-the-ndss/changes-to-the-ndss/> (viewed May 2021).
- 15 Australian Government, Commonwealth Ombudsman (private health insurance). How health insurance works: private health insurance basics (product tiers). https://www.privatehealth.gov.au/health_insurance/howitworks/producttiers.htm (viewed May 2021).
- 16 Living Evidence for Diabetes Consortium. Australian evidence-based clinical guidelines for diabetes 2020: medical device technology for the management of type 1 diabetes. <https://app.magicapp.org/#/guideline/ESAbPE> (viewed Mar 2021).
- 17 Insulin pump therapy. *Drug Ther Bull* 2012; 50: 105–108.
- 18 McAdams BH, Rizvi AA. An overview of insulin pumps and glucose sensors for the generalist. *J Clin Med* 2016; 5: 5.
- 19 Diabetes Australia. Insulin pumps. <https://www.diabetesaustralia.com.au/insulin-pumps> (viewed Nov 2019).
- 20 Cappon G, Vettoretti M, Sparacino G, Facchinetti A. Continuous glucose monitoring sensors for diabetes management: a review of technologies and applications. *Diabetes Metab J* 2019; 43: 383–397.
- 21 Battelino T, Conget I, Olsen B, et al. The use and efficacy of continuous glucose monitoring in type 1 diabetes treated with insulin pump therapy: a randomised controlled trial. *Diabetologia* 2012; 55: 3155–3162.
- 22 Juvenile Diabetes Research Foundation Continuous Glucose Monitoring Study Group. Effectiveness of continuous glucose monitoring in a clinical care environment: evidence from the Juvenile Diabetes Research Foundation continuous glucose monitoring (JDRF-CGM) trial. *Diabetes Care* 2010; 33: 17–22.
- 23 Pickup JC, Freeman SC, Sutton AJ. Glycaemic control in type 1 diabetes during real time continuous glucose monitoring compared with self monitoring of blood glucose: meta-analysis of randomised controlled trials using individual patient data. *BMJ* 2011; 343: d3805.
- 24 Craig ME, Twigg SM, Donaghue KC, et al; Australian Type 1 Diabetes Guidelines Expert Advisory Group. National evidence-based clinical care guidelines for type 1 diabetes in children, adolescents and adults. Canberra: Australian Government, Department of Health and Ageing; 2011. <https://diabetessociety.com.au/documents/Type1guidelines14Nov2011.pdf> (viewed Apr 2021).
- 25 Liu NF, Brown AS, Folijs AE, et al. Stigma in people with type 1 or type 2 diabetes. *Clin Diabetes* 2017; 35: 27–34.
- 26 Huckvale K, Adomaviciute S, Prieto JT, et al. Smartphone apps for calculating insulin dose: a systematic assessment. *BMC Med* 2015; 13: 106.
- 27 Hirsch IB, Battelino T, Peters AL, et al. Role of continuous glucose monitoring in diabetes treatment. Arlington, VA: American Diabetes Association, 2018. https://professional.diabetes.org/sites/professional.diabetes.org/files/media/final_ada-abbott_cgm_compendium_final.pdf (viewed May 2021).
- 28 Rodbard D. Continuous glucose monitoring: a review of successes, challenges, and opportunities. *Diabetes Technol Ther* 2016; 18 (Suppl): S2–S13.
- 29 Tauschmann M, Thabit H, Bally L, et al. Closed-loop insulin delivery in suboptimally controlled type 1 diabetes: a multicentre, 12-week randomised trial. *Lancet* 2018; 392: 1321–1329.
- 30 Benhamou P-Y, Franc S, Reznik Y, et al. Closed-loop insulin delivery in adults with type 1 diabetes in real-life conditions: a 12-week multicentre, open-label randomised controlled crossover trial. *Lancet Digit Health* 2019; 1: e17–e25.
- 31 Brown SA, Kovatchev BP, Raghinaru D, et al. Six-month randomized, multicenter trial of closed-loop control in type 1 diabetes. *N Engl J Med* 2019; 381: 1707–1717.
- 32 Bally L, Thabit H, Kojzar H, et al. Day-and-night glycaemic control with closed-loop insulin delivery versus conventional insulin pump therapy in free-living adults with well controlled type 1 diabetes: an open-label, randomised, crossover study. *Lancet Diabetes Endocrinol* 2017; 5: 261–270.
- 33 Thabit H, Tauschmann M, Allen JM, et al. Home use of an artificial beta cell in type 1 diabetes. *N Engl J Med* 2015; 373: 2129–2140.
- 34 Pease A, Lo C, Earnest A, et al. The efficacy of technology in type 1 diabetes: a systematic review, network meta-analysis, and narrative synthesis. *Diabetes Technol Ther* 2020; 22: 411–421.
- 35 Pease A, Lo C, Earnest A, et al. Time in range for multiple technologies in type 1 diabetes: a systematic review and network meta-analysis. *Diabetes Care* 2020; 43: 1967–1975.
- 36 Bekiari E, Kitsios K, Thabit H, et al. Artificial pancreas treatment for outpatients with type 1 diabetes: systematic review and meta-analysis. *BMJ* 2018; 361: k1310.
- 37 Lal RA, Basina M, Maahs DM, et al. One year clinical experience of the first commercial hybrid closed-loop system. *Diabetes Care* 2019; 42: 2190–2196.
- 38 Sherr JL. Closing the Loop on Managing youth with type 1 diabetes: children are not just small adults. *Diabetes Care* 2018; 41: 1572–1578.
- 39 Weaver KW, Hirsch IB. The hybrid closed-loop system: evolution and practical applications. *Diabetes Technol Ther* 2018; 20: S216–S223.
- 40 Medtronic Australia. Products: MiniMed 670G [website]. Medtronic, 2020. <https://www.medtronic-diabetes.com.au/products/minimed-670g> (viewed Mar 2020).
- 41 Pease AJ, Zomer E, Liew D, et al. Cost-effectiveness analysis of a hybrid closed-loop system versus multiple daily injections and capillary glucose testing for adults with type 1 diabetes. *Diabetes Technol Ther* 2020; 22: 812–821.
- 42 Australian Government, Department of Health. Private health insurance: prostheses list part C — other. Canberra: Commonwealth of Australia, 2019. <https://www.health.gov.au/resources/publications/prostheses-list> (viewed Nov 2019).
- 43 Australian Government, Department of Health. Private health insurance reforms: gold, silver, bronze, basic product tiers [website]. <https://www1.health.gov.au/internet/main/publishing.nsf/Content/private-health-insurance-reforms-fact-sheet-gold-silver-bronze-basic-product-categories> (viewed Nov 2019).
- 44 National Diabetes Services Scheme. Continuous and flash glucose monitoring eligibility assessment (type 1 diabetes: age under 21 years). <https://www.ndss.com.au/about-the-ndss/ndss-forms> (viewed Mar 2020).
- 45 National Diabetes Services Scheme. Changes to the NDSS — continuous glucose monitoring initiative: FreeStyle Libre added and eligibility criteria streamlined from 1. March 2020. <https://www.ndss.com.au/about-the-ndss/changes-to-the-ndss/changes-to-the-ndss-from-1-march-2020/> (viewed Oct 2020).
- 46 National Diabetes Services Scheme. How to access a free blood glucose meter. 2019. <https://www.ndss.com.au/wp-content/uploads/changes-to-ndss/from-1-dec-2018/20181201-fact-sheet-how-to-access-free-blood-glucose-meter.pdf> (viewed Nov 2019).
- 47 Australian National Adult Insulin Pump Therapy Working Group. Provision of quality care for adults with type 1 diabetes requiring insulin pump therapy (IPT). *Infusystems Asia* 2013; 8: 1–6. ■

Supporting Information

Additional Supporting Information is included with the online version of this article.