A New Era in the Management of T2D: Automated Insulin Delivery

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DISCLOSURES

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INTRODUCTION

Diabetes affects an estimated 38.4 million people in the United States, with an increasing prevalence of both type 1 diabetes (T1D) and type 2 diabetes (T2D).[1] Approximately 90% of adults with T2D and 50% of adults with T1D receive diabetes care from a primary care clinician (PCC).[2] However, PCCs face many challenges in diabetes management, including inadequate clinic time and resources.[3] Advanced diabetes technology, such as automated insulin delivery (AID) systems, may help alleviate the burden on PCCs and improve diabetes management in primary care. Additionally, the use of diabetes technology in primary care allows more people living with diabetes to be reached, given the geographic gaps in the availability of endocrinologists across the United States.[4]

Key takeaways

- Rates of type 2 diabetes continue to increase and, despite the advancement of noninsulin therapeutics, there remains a need for insulin and for access to improved insulin delivery methods.
- Diabetes technology, including automated insulin delivery (AID), has advanced substantially and provides better diabetes management support for the patient, family, and health care team.
- Providing AID in primary care practice improves efficiencies in diabetes care, glycemic control without increasing hypoglycemia risk, and time in range compared to multiple daily injections of insulin and continuous subcutaneous insulin infusion.
- Implementing diabetes technology like continuous glucose monitoring and AID systems is feasible, supports data interpretation in primary care practice, and provides benefits to patients and clinicians.

WHAT IS AID?

AID is a technology that helps patients optimize their insulin use. Each AID system contains 3 components: 1) an insulin pump, 2) a continuous glucose monitoring (CGM) system, and 3) an algorithm that determines insulin delivery.[5] These components allow AID systems to automatically deliver, monitor, and titrate insulin based on real-time data. Depending on the model and brand of the AID system, the algorithm can be hosted in the pump hardware itself, with tubed and tubeless options, or on a separate phone app.[5]

All currently available AID systems integrate with ≥1 CGM systems and adjust insulin delivery either by modulating the pre-programmed basal rates or by using an algorithm-derived rate with microboluses, or microdoses, of insulin delivered every 5 minutes.[5] AID systems, which can adjust insulin delivery based on sensor glucose values, are preferred over nonautomated pumps and multiple diabetes injections (MDI) in people with T1D and T2D and have largely replaced the use of standard insulin pumps.[5] At the time of this writing, 3 AID systems are currently approved for use by people with T2D in the United States.[5]

BENEFITS OF NEW AID SYSTEMS

While AID systems have been available for years, they are increasingly recognized for their benefits in both T1D and T2D, leading to improved care.[5] New AID systems are simpler and easier to implement than older systems, and PCCs can bill for technology integration as part of care, making them

more practical to incorporate. Implementing AID can help save time and effort in clinic while also improving patient outcomes and quality of life.[5] With the recognition of AID systems as the preferred insulin delivery method for not only T1D but recently T2D, now is the time for PCCs to reconsider how they use AID.[5] PCCs can play an active role in implementing these systems in their own clinical practices, as well as in providing guidance to patients with diabetes who want to learn and collaborate more effectively with specialists.

Management of insulin therapy in primary care presents many challenges, including therapeutic inertia, insulin titration difficulties, and suboptimal adherence to insulin therapy, especially in those receiving MDI.[6,7] Therapeutic inertia, when driven by a lack of treatment adjustment to reach glycemic targets, can be addressed in part with AID, which enables faster treatment intensification. Optimally, a basal insulin titration strategy involves twice-weekly self-titration adjustments supported by clinicians. This is not feasible in most primary care practices.[8] Since some AID systems automate insulin titration, they enable more effective dose adjustment with fewer touchpoints between the patient and clinician. Median time to treatment intensification with insulin following an above-target glycated hemoglobin (HbA1c) ranged from 1.3 to 4.9 years for patients taking ≥2 oral antihyperglycemic drugs.[9] The use of AID may help patients be more accepting of the change to insulin therapy by simplifying management compared with MDI.

CASE STUDY

A 45-year-old man with a 6-year history of T2D presents to his primary care clinic for a diabetes follow-up visit. The patient's HbA1c today is 9.1%, which is largely unchanged from his values during the past year, despite titration of basal insulin. His fasting blood glucose values average 80-90 mg/dL on most days.

The patient is currently taking metformin 2000 mg daily, glipizide extended-release 20 mg daily, empagliflozin 25 mg daily, and 65 units of insulin glargine daily. He previously had a severe adverse reaction to a glucagon-like peptide-1 (GLP-1) receptor agonist and is not a candidate for GLP-1 therapy. The patient understands that he needs mealtime insulin to achieve glycemic control, but he is concerned about his ability to remember and accurately deliver mealtime injections.

In this case study, the patient is somewhat willing to intensify therapy by adding mealtime insulin to his diabetes regimen but has legitimate concerns. The use of an AID system could reduce his apprehension about remembering and accurately delivering mealtime insulin doses. While he did not mention injection burden, AID would automate his basal insulin injection, helping him achieve glycemic targets more safely and effectively. This is important due to his history of elevated HbA1c values.

EFFECTIVENESS OF AID SYSTEMS

AID systems offer the ability to achieve glycemic outcomes more quickly and effectively than MDI, addressing therapeutic inertia and problems with persistence that often accompany MDI, while protecting against hypoglycemia (**TABLE 1**).[7,8,10-12] Additionally, AID systems can ease the burden of insulin use and management for both clinicians and patients. Some systems automatically titrate insulin delivery based on changing insulin needs and allow for a simplified bolus approach that minimizes the need for carbohydrate counting. Beyond glycemic endpoints, use of AID systems is associated with meaningful improvements in patient-reported outcomes, such as higher treatment satisfaction, improved quality of life, and reduced diabetes distress.

There are certain limitations and precautions that should be considered.[13] AID systems require the user to wear multiple components, with a pump site and a sensor attached to the skin. While infrequently resulting in adverse events, technical problems can occur with each of the components—the insulin pump, the insulin, and the CGM device—and the algorithm may not always compensate completely for malfunctions.[14,15] Alert fatigue from alarms (e.g., high or low glucose, battery life, and insulin remaining) and cost concerns are other challenges that patients may face.[14] Additionally, patients, providers, and caregivers require special training, ideally with a certified diabetes educator, at regular intervals.

CLINICAL EVIDENCE FOR AID SYSTEMS IN T2D

Studies of AID systems have shown that they are effective and safe for improving glycemic outcomes in insulin-requiring T2D, including both clinical trials and real-world studies. Based on the outcomes of these studies, there are currently 3 AID systems approved for patients with T2D, key details of which are described in **TABLE 2**.[16]

Omnipod® 5

In the SECURE-T2D nonrandomized clinical trial, 305 adults with T2D from 21 clinical centers in the United States were enrolled to evaluate the association of tubeless AID with HbA1c.[17] Participants were aged 18 to 75 years, had T2D, and had been using insulin for at least 3 months before screening; none had used AID prior to trial enrollment. Investigators intentionally enrolled participants across diverse racial, ethnic, and socioeconomic backgrounds, who not only reflect the US population with T2D but are also often underrepresented in clinical trials.

After a 14-day standard therapy phase, participants used the Omnipod 5 AID System for 13 weeks. Following AID use, HbA1c levels decreased from a mean of 8.2% at baseline to 7.4% at 13 weeks (P <.001), and time in range (TIR) (70-180 mg/dL) increased from a mean of 45% to 66% (P <.001). These

TABLE 1. Comparison of approaches for insulin delivery in diabetes.

Dimension	Insulin injection therapy	CSII pumps	AID systems
Hypoglycemia prevention strategy	Reactive, limited, and relies on patient vigilance	Smaller increments of insulin dosing but still limited prevention	Proactive, with reduction or suspension of insulin based on CGM
Adaptable to changing insulin needs	Unable to adapt	Manual, temporary basal rates and corrections	Some systems adapt automatically without PCC or patient input
Daily cognitive load for patient	High (carbohydrate counting, dose calculations, estimating active insulin)[10]	High (carbohydrate entry, basal tuning, frequent manual corrections)	Reduced, automation handles corrections based on predicted trends in CGM values
Flexibility to personalize therapy	Yes, but burden to remember different carbohydrate ratios or targets sits with patient for daily dose decisions	Yes, can program different settings by time of day into pump, requires manual adjustments	Yes, some systems offer personalized glucose target options to avoid compromising, algorithm softens math on daily basis
Need to wear devices	No, CGM optional	Yes, pump; CGM optional	Yes, pump and CGM
Lifestyle flexibility	Limited given long-acting insulin profiles	Moderately flexible, tubing and infusion sets can be limiting	Higher flexibility; exercise and sleep modes along with automation support variable lifestyles
Discreetness	No visible device, patients report hesitations around delivering injections in social settings	Pump may be visible, tubing may be inconspicuous, many patients prefer tubeless form factor	Pump may be visible, most patients prefer tubeless form factor, CGM may be inconspicuous
Ongoing titration needed	Yes, full reliance on manual titration continuously	Yes, full reliance on manual adjustment of pump settings	Reduced significantly; though settings should be reviewed periodically to optimize or troubleshoot
Data visibility and remote monitoring	Minimal (SMBG logs)	Some (pump downloads, SMBG logs, optional CGM reports)	Rich (CGM + insulin delivery reports), enables virtual care

Abbreviations: CSII, continuous subcutaneous insulin infusion; SMBG, self-monitoring of blood glucose.

glycemic improvements occurred alongside a reduction in total daily insulin requirements with a change from a mean of 0.80 u/kg/d at baseline to 0.57 u/kg/d with AID (P <.001).[17]

A subanalysis of SECURE-T2D evaluated outcomes in participants who previously used basal-only (without bolus) insulin.[18] Of the 305 participants enrolled, 63 used basal-only insulin. HbA1c decreased from a mean of 8.6% at baseline to 7.5% (P <.001) and mean TIR (70-180 mg/dL) increased from 40% to 64%. Total daily insulin was reduced by 6.3 units per day (P =.04) with negligible weight gain of 0.9 kg (P =.03).[18] Outcomes improved regardless of GLP-1 receptor agonist or sodium-glucose cotransporter-2 (SGLT-2) inhibitor use.[17]

Another study evaluated the Omnipod 5 in a 26-week extension phase, following an 8-week single-arm trial in patients with T2D and baseline HbA1c ≥8%.[19] From baseline through the end of the extension phase, HbA1c decreased by 1.6% (P <.0001) and TIR increased by 22.4% (P <.0001) with Omnipod 5. There were no significant changes in body mass index (BMI) or increases in total daily insulin requirements, demonstrating positive longer-term outcomes with Omnipod 5 use in T2D.

A real-world study of the Omnipod 5 System in adults with T2D was a retrospective analysis of 23,664 patients who had ≥90 days of sufficient CGM data (≥75% of days with ≥220 readings).[20] Those using the 110 mg/dL target glucose setting achieved the highest TIR (68%), followed by the 120 mg/dL setting (63%), and the 130-150 mg/dL setting (55%). There were improvements in the glucose management indicator (GMI)[21] for those with higher self-reported baseline HbA1c levels, while those meeting the HbA1c clinical target at baseline maintained a low GMI with Omnipod 5.[20]

Control-IQ+ (Mobi or t:slim X2)

In a 13-week multicenter randomized trial, 319 adults with insulin-treated T2D were assigned 2:1 to AID with Control-IQ+ or to continue their usual insulin-delivery method, with both groups using CGM.[22] At 13 weeks, AID produced a larger HbA1c reduction than control (–0.9% vs –0.3%; adjusted difference –0.6%; P <.001). TIR (70-180 mg/dL) increased with AID (48% to 64%) but was essentially unchanged in the control group (51% to 52%). Other CGM hyperglycemia metrics favored AID. Hypoglycemia was uncommon in both groups, with 1 severe event in the AID group.[22] Additionally, a reduction in mean total daily insulin dose was observed in the AID

group (95 to 87 units per day) compared to the control group (102 to 104 units per day), and mean body weight increased from baseline in the AID group (+2.4 kg) compared to the control group (+0.9 kg).[22]

Another randomized study of the t:slim X2 pump with Control-IQ+ in adults with insulin-treated T2D stratified participants by C-peptide status into high (n=195) and low (n=59) groups.[23] AID reduced HbA1c by 0.8% from baseline and achieved significantly greater HbA1c improvement than control in both the high (P <.001) and low (P =.02) C-peptide subgroups, with similar findings in adults ≥65 years.[23]

MiniMed 780G

A 13-site, single-arm, open-label study evaluated the safety and effectiveness of the MiniMed 780G AID in 95 adults with insulin-requiring T2D previously using basal-bolus insulin. After a ~21-day run-in and ~90-day study period, mean HbA1c decreased from 7.9% to 7.2% (P <.001), and TIR (70-180 mg/dL) during the last 6 weeks reached 80.9% (95% CI: 78.4%, 83.1%), meeting prespecified effectiveness criteria (P <.001). Total daily insulin dose increased by 14 units/day, with no significant changes in weight or BMI. No severe hypoglycemia, diabetic ketoacidosis, hyperosmolar hyperglycemic state, or serious/unanticipated device-related adverse effects were reported, supporting safe insulin intensification and improved glycemic outcomes.[24]

A real-world analysis of de-identified US CareLink data evaluated glycemic outcomes in 8542 MiniMed 780G users with either T1D or T2D who were aged ≥65 years. It showed a mean TIR (70-180 mg/dL) of 78.4% with very low time below range (0.9%) and a GMI of 6.8%.[25] Users with recommended optimal settings (100 mg/dL target and 2-hour active insulin time; n=2753) achieved higher TIR and time in tight range (70-140 mg/dL; 81.9% and 55.9%) and lower hyperglycemia metrics vs users who did not use recommended optimal settings (all P <.001). Similar patterns were seen in those ≥75 years, with no meaningful differences between people with T1D vs T2D, supporting that AID can help older adults meet consensus glycemic targets and that optimal settings further improve control.[25]

TABLE 2. Comparison of AID systems approved for T2D.[16]

Characteristic	Omnipod 5	Tandem Control-IQ+ (Mobi or t:slim X2)	MiniMed 780G
CGM type	Dexcom G6, Dexcom G7, FreeStyle Libre 2 Plus Sensor, FreeStyle Libre 3 Plus Sensor	Dexcom G6, Dexcom G7, FreeStyle Libre 3 Plus Sensor	Guardian 4, Simplera Sync, Abbott Instinct
CGM wear	10-15 days (Dexcom) 14-15 days (Libre) Dexcom G6: reusable transmitter with battery life of 3 months Dexcom G7: disposable transmitter Libre: disposable transmitter	10-15 days (Dexcom) 14-15 days (Libre) Dexcom G6: reusable transmitter with battery life of 3 months Dexcom G7: disposable transmitter Libre: disposable transmitter	7 days (Guardian 4, Simplera Sync) 15 days (Instinct) Reusable transmitter needs to be charged between changes Disposable transmitter (Simplera Sync Sensor) also available Instinct: disposable transmitter
Real-time CGM data sharing	Dexcom Share or LibreLinkUp	Dexcom Share and/or Sugarmate	Medtronic Carelink Connect App, which also shows pump data
Considerations	If using a Dexcom sensor, requires Dexcom CGM run on a compatible phone in order to access Closed Loop in addition to PDM device and Pod on body, except when using a 15-day Dexcom G7, which can be used with the receiver Libre sensor can be directly connected and managed by the Omnipod controller Can use pharmacy benefit vs DME Only true tubeless option Also has auto-cannula insertion	Pump is metal and alarms in metal detectors CGM signal loss can be common if pump is facing away from CGM or toward body Remote bolusing is an option on the Tconnect app	Option for 7-day extended wear infusion set and cartridge Guardian 4 utilizes a reusable transmitter that requires charging in between sensor changes

Abbreviations: DME, durable medical equipment; PDM, Personal Diabetes Manager.

Note: Support for writing the prescription for components of the AID systems mentioned in this article and navigating prior authorization can be found at pro.diabeteswise.org.

Adapted from Town M, 2026.

GUIDELINE RECOMMENDATIONS FOR AID USE IN T2D

Clinicians have often taken a "technology-forward" approach with T1D management, incorporating available advances into practice. In contrast, use of technology for insulin-requiring T2D patients has often been treated as a last resort. Recently, uptake of CGM in T2D has been increasing in primary care.[26] Similarly, AID systems are commonly used in patients with T1D but less often in insulin-requiring adults with T2D, despite mounting evidence supporting AID use.[27] One analysis of studies on the Omnipod 5 System in patients with T1D or T2D found that, across clinical studies, there was no difference in TIR or HbA1c outcomes by diabetes type, after accounting for baseline HbA1c.[28]

In the 2026 American Diabetes Association (ADA) *Standards of Care*, AID is noted as the preferred insulin delivery system for both those with T1D and those with insulin-requiring T2D. Key ADA recommendations are as follows[5]:

- AID systems are suggested for individuals on MDI and those with other forms of insulin-deficient diabetes.
- Consider AID systems for those people with T2D treated with basal insulin not achieving individualized glycemic goals.
- People with T2D who continue to produce insulin have been shown to benefit from AID. There should be no requirement of C-peptide level, presence of islet autoantibodies, or duration of insulin treatment before initiation of AID.
- Choice of an AID system should be made based on the individual's circumstances, preferences, and needs.

HOW TO USE AID IN PRIMARY CARE

While implementing AID in primary care may be unfamiliar to many, the overall process is straightforward and similar to other medical devices and diabetes technology, such as CGM. Patients who are prescribed AID should receive education and counseling on what to expect, how to use the technology, and how they will receive the equipment. In contrast to CGM, for which patients can often self-educate with provided training materials, AID instruction usually requires a trained diabetes educator.[5] For those new to AID systems, manufacturers of the devices support patient training and use. Explaining the nuances of the systems used for AID can help patients select the one that best suits their needs, as well as prepare them to use it correctly.[13] Essential discussion points include how to use its data, the expected duration of each wearable, and basic troubleshooting for technical issues.[13]

A rule-in approach for prescribing AID in T2D may be helpful; clinicians might consider clinical cues that indicate a patient may benefit from AID, including those who:

- Require rapid-acting insulin in addition to basal insulin
- Want improved glycemic control without increased hypoglycemia
- Demonstrate recently unchanged HbA1c results, indicating a stall in progress
- Hope for a simpler and safer glycemic control regimen

PCCs can prescribe AID systems electronically, sometimes requiring a statement of medical necessity and prescription order.[29-31] Other clinic staff can assist the patient in navigating insurance coverage and obtaining the AID, as well as providing training on proper use. While clinicians do not need to understand all the intricacies of how AID algorithms work, it is important to be familiar with the parameters that can be adjusted to optimize insulin delivery, as these differ by system.[13] Details and instructional resources for clinicians and patients are available on the manufacturers' websites.[29-31]

AID systems offer PCCs a way to achieve glycemic targets safely and more effectively than with injection therapy, automate titration in between clinic visits, and reduce the burden for people living with T2D. After completing the process of prescribing and monitoring an AID system even once, each subsequent effort becomes easier and more familiar.

SUMMARY

AID offers a practical and meaningful way to improve diabetes management in the primary care setting, where most adults with T2D are treated. It combines an insulin pump, a CGM device, and a dosing algorithm to automate insulin delivery. For patients, AID offers simplification and reduced burden, with adaptive systems that adjust insulin delivery to a patient's need outside of clinician touchpoints.

Clinical trials and real-world studies in insulin-requiring T2D show significant improvements in HbA1c and TIR, with low hypoglycemia risk in older adults, independent of C-peptide level.

Implementation of AID is similar to that of other diabetes technologies. It uses a "rule-in" approach for patients who need treatment intensification, struggle with injections, or seek simpler and safer glycemic control. Implementation requires education, training, and support for clinicians and patients and relies on a team that includes a diabetes educator. Goals encompass coordination of coverage support, optimization of the AID settings, and integration with typical workflows.

For additional information on AID systems, readers are directed to the 2022 Consensus Recommendations for the Use of Automated Insulin Delivery Tech-

nologies in Clinical Practice, freely accessible online: https://academic.oup.com/edrv/article/44/2/254/6692818.[32]

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