Recent Advances in Diabetes Technology and Activities of the American Diabetes Association Diabetes Technology Interest Group

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The American Diabetes Association (ADA) special interest groups are composed of ADA professional members who have shown dedication to and made achievements in a specific area of diabetes clinical practice and research (1). The ADA Diabetes Technology Interest Group (ADA-DT-IG) is one of 16 such interest groups that engage in networking, professional development, and educational programs. The leadership team for each interest group includes a chair, chair-elect, immediate past chair, communications director, advisors, an early career representative, and a membership advisory group liaison. Through extensive planning and coordination, interest group members organize educational webinars on various topics of clinical and research importance. In this review, we summarize the activities of the ADA-DT-IG, in addition to developments in the field of diabetes technology in 2022 and 2023.

Interest Group Activities

The ADA-DT-IG organized several webinars in the past 2 years. Some of these were recorded and are available online to all health care professionals. Others were presented in collaboration with other ADA interest groups as a part of the ADA members-only Hands On: Tips to Improve Diabetes Care webinar series. This series was developed by diabetes technology, primary care, exercise physiology, behavioral medicine, and psychology interest groups and funded by the Leona M. and Harry B. Helmsley Charitable Trust. Table 1 presents a list of recent ADA-DT-IG presentations, with websites to access those not restricted to ADA members.

The ADA-DT-IG also held live sessions titled "Understanding the Current State of Apps for Supporting Effective Diabetes Care" and "Discussion on Diabetes Technology: Registry Study of Hybrid Closed-Loop Systems During Pregnancy" at the ADA's 82nd and 83rd Scientific Sessions, respectively. In addition, the ADA-DT-IG hosted networking sessions at these meetings, at which ADA members could meet likeminded peers to learn more about diabetes technology and network for possible collaboration on future research.

Each year, the ADA-DT-IG's leadership team review abstracts submitted for possible inclusion in the annual Scientific Sessions program. Starting in 2022, the group began its Early Career Abstract Award to highlight an outstanding abstract submission each year. Award winners to date and their research are listed in Table 2.

In collaboration with the ADA Pregnancy Interest Group, the ADA-DT-IG has been working to build a registry for the study of diabetes technology use in pregnancy. This registry can play a key role in future research in this area.

ADA-DT-IG members contributed to several ADA continuing education (CE) events and online courses related to diabetes technology, such as the Making Diabetes Technology Work and Diabetes Is Primary CE programs.

Newer Diabetes Technology Systems

There have been many advances in the field of diabetes technology in 2022 and 2023. These are listed chronologically by their date of clearance by the U.S. Food and

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*The officers of the American Diabetes Association Diabetes Technology Interest Group for 2022–2023 included chair Joseph Aloi, MD; chair-elect Viral N. Shah, MD; communications director Halis Kaan Akturk, MD; advisors Alexis M. McKee, MD, and Laya Ekhlaspour, MD; early career representative Stephanie Kim, MD; and membership advisory group liaison Estelle Everett, MD.

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TABLE 1 ADA-DT-IG Webinar Dates and Titles in 2022–2023

Date	Title	Link*
January 2022	I Read It Online: Guiding Patients Toward Reliable Information Sources on the Internet	Hands On: Tips to Improve Diabetes Care webinar series
February 2022	Diabetes Technology: The Future Is Now	https://www.youtube.com/watch?v=y3jSx5FAMiE
June 2022	Using Diabetes-Related Technology to Support and Enhance Exercise	Hands On: Tips to Improve Diabetes Care webinar series
October 2022	Toward Fully Automated Glucose Management: Insulin Delivery Algorithms, Better and Smarter Insulins, Second (and Third) Hormones, and Adjunctive Drugs	Interest group webinar (expired)
October 2022	New Options in Hybrid Closed-Loop Systems	Hands On: Tips to Improve Diabetes Care webinar series
January 2023	Should Hybrid Closed-Loop Insulin Delivery Be Used During Pregnancy?	https://professionaleducation.diabetes.org/URL/Product/HCLIDOD
April 2023	Facilitating Technology Use in the Transition to Diabetes Independence	https://professionaleducation.diabetes.org/URL/Product/FTUTDIOD
August 2023	Empowering Elderly Patients: Harnessing Diabetes Technology for Optimal Management	https://professionaleducation.diabetes.org/URL/Product/EEPOD

*Direct links for the Hands On: Tips to Improve Diabetes Care webinar series are not available, and the October 2022 interest group webinar is no longer available online.

Drug Administration (FDA) in Table 3 and summarized below. The ADA-DT-IG shared updates on the status of these clearances with ADA members via its online forum website.

Omnipod 5 Automated Insulin Delivery System

In January 2022, the FDA approved the Omnipod 5 automated insulin delivery (AID) system, a type of technology also known as hybrid closed-loop (HCL) insulin delivery systems. This system features a tubeless pod insulin pump connected to a Dexcom G6 continuous glucose monitoring (CGM) sensor via Bluetooth, with a control algorithm to modulate insulin delivery based on real-time glucose levels and a mobile app with an integrated bolus calculator (2).

This system's algorithm takes not only glucose levels, but also glucose trends, into account when adjusting insulin delivery. Glucose targets when the system is in automated mode can be customized from 110 to 150 mg/dL in 10 mg/dL increments. Currently, this system can only be used in Android smartphone operating systems; the IOS-compatible version is under FDA review.

Eversense E3 CGM System

In February 2022, the FDA cleared the Eversense E3 CGM system. This implantable CGM sensor can be used

TABLE 2 ADA-DT-IG Early Career Abstract Award Winners and Abstract Titles

Year	Name	Title	Link to Abstract
2022	Viral Shah, MD	Discordance Between Glucose Management Indicator (GMI) and A1C in Well-Controlled Type 1 Diabetes (T1D) and Nondiabetic Population	https://diabetesjournals.org/diabetes/article/71/Supplement_1/88-OR/145789/88-OR-Discordance-between-Glucose-Management
2023	Sewon Bann, MD	A Calibration Protocol for Continuous Glucose Monitor Accuracy in the ICU	https://diabetesjournals.org/diabetes/article/72/Supplement_1/229-OR/150449/229-OR-A-Calibration-Protocol-for-Continuous

TABLE 3 FDA Clearance of Diabetes Technology Devices in 2022–2023

Date	Products Cleared by the FDA	Key Features
January 2022	Omnipod 5 AID system	First tubeless AID system
February 2022	Eversense E3 CGM system	6-Month implantable CGM sensor
June 2022	Freestyle Libre 3 CGM system	Smallest CGM sensor to date
September 2022	Tempo connected insulin pen cap	First pen cap that fits basal and bolus insulin pens
December 2022	Dexcom G7 CGM system	Combined transmitter and sensor; smaller size
March 2023	Freestyle Libre 2 and Libre 3 (approved for use with an AID system and in pregnancy)	Libre 2 and Libre 3 CGM sensors will be used in AID systems
	Medtronic MiniMed 780G AID system	Lowest glucose target (100 mg/dL) of any AID system; updated CGM with G4 sensor
April 2023	Omnipod GO patch insulin pump	First basal-only patch pump
May 2023	iLet Bionic Pancreas AID system	No carbohydrate counting required
July 2023	Tandem t:slim X2 Mobi AID system	Smallest AID system to date

for up to 6 months (3) and is approved for use in adults (≥18 years of age) with diabetes.

This system must be calibrated twice daily for the first 21 days and then once daily for the remainder of the 6-month use. It has a 24-hour warm-up time and is the only CGM system with on-body vibration alerts from a wearable transmitter.

Freestyle Libre 3 CGM System

In June 2022, the FDA cleared the FreeStyle Libre 3 CGM system for use in people with diabetes who are ≥4 years of age. Unlike previous intermittently scanned FreeStyle Libre systems, it is a real-time system that continuously reads and displays glycemic data without requiring users to scan the sensor with a reader or smartphone to see results (4).

The Libre 3 is the smallest and thinnest CGM sensor to date and can be used for up to 14 days. It also has strong Bluetooth integration, with a range of up to 33 feet, which represents a 50% increase over the range of other CGM systems.

Tempo Connected Insulin Pen Cap

In September 2022, the FDA cleared the Tempo connected insulin pen cap and app, which work with Eli Lilly's basal and bolus insulin pens. The Tempo Smart Button is a reusable medical device that attaches to the top of Tempo pens (Eli Lilly's prefilled, disposable insulin pens) (5).

When paired via Bluetooth, the Smart Button is intended to detect, store, and transfer insulin dose–related data to the compatible app. The app, called TempoSmart, records insulin dose information and facilitates data-sharing between adults with diabetes and their diabetes health care providers.

Dexcom G7 CGM System

In December 2022, the FDA cleared the Dexcom G7 CGM system for use in individuals ≥2 years of age. The Dexcom G7 system consists of a transmitter and CGM sensor all in one and is applied with a simplified one-click applicator. This system is significantly smaller than the Dexcom G6 sensor.

Individuals who are ≥7 years of age can use the device on the back of the upper arm, whereas those between the ages of 2 and 6 years can use it at the back of the upper arm and on the upper buttocks. The G7 warm-up time is 30 minutes, compared with 2 hours with the G6 (6). FDA clearance included the use of the device in pregnancy use as well.

The G7 has some other new features, including a grace period through which users can extend the use of a sensor for 12 hours beyond the 10-day use period. Users can also delay the first alert for high glucose values until their glucose level is at or beyond the designated alert setting for a

specific amount of time from 15 minutes to 6 hours. A quiet mode vibrate feature enables users to receive alerts through vibration only without sound. A quiet mode silence all feature enables users to shut off all alerts. This setting can be enabled for up to 6 hours. This system can also store 24 hours of data when no Bluetooth connection is available, allowing it to then backfill data when the connection is restored.

New Indications for Modified FreeStyle Libre 2 and Libre 3 CGM Systems

In March 2023, the FreeStyle Libre 2 and Libre 3 CGM systems received FDA clearance to be used with AID systems (7). This use requires modified sensors that are expected to be available in early 2024. The FDA also extended the use of these modified sensors to individuals ≥2 years of age, compared with ≥4 years of age for the currently available FreeStyle Libre sensors, and also allowed their use in pregnancy.

These modified CGM sensors can be worn for 15 days, as opposed to the 14-day use period for the currently available FreeStyle Libre sensors. In April 2023, the FreeStyle Libre 3 CGM system also received FDA clearance for a display device, which is a requirement for Medicare CGM coverage (8).

MiniMed 780G AID System

Also in March 2023, the FDA cleared the MiniMed 780G AID system, which has been in use in Europe since 2020. This HCL system is approved for individuals with type 1 diabetes who are ≥7 years of age (9).

In the system's automated mode, the blood glucose target can be adjustable from 100 to 120 mg/dL in 10 mg/dL increments, as opposed to the MiniMed 770G system, which has a single target of 120 mg/dL. Of note, 100 mg/dL is the lowest blood glucose target in any FDA-cleared AID system to date.

The 780G system has meal detection technology that delivers automated correction boluses every 5 minutes to optimize glucose levels. It can be used in patients requiring between 8 and 250 units/day of insulin. The system can be paired with the Guardian 3 and Guardian 4 CGM systems for automated mode. The Guardian 4 sensor does not require any calibrations with fingerstick blood glucose monitoring (BGM), and users reported needing fewer fingerstick BGM confirmations when using the system in automated mode compared with the 770G system (10). This system also has a smartwatch display with its mobile app. Users can also use the FDA-approved extended infusion set for up to 7 days with this system.

Omnipod GO

In April 2023, the Omnipod GO received FDA clearance. This insulin delivery device was designed for people with type 2 diabetes who require long-acting insulin and do not want daily injections (11). It provides a fixed rate of continuous rapid-acting insulin for 72 hours, with seven different daily rates ranging from 10 to 40 units/day. It was cleared for use with all FDA-approved rapid- and ultra-rapid-acting insulins.

iLet Bionic Pancreas AID System

In May 2023, the FDA cleared the iLet Bionic Pancreas AID system.

This system is started by entering the user's weight and provides three glucose target options: usual, lower, and higher. Users do not have to enter any carbohydrate amounts for mealtime bolusing (12). Instead, they select a usual, more than usual, or less than usual bolus option (9). The system automatically adjusts insulin delivery based on the user's dosing history for similar previous meal announcements.

The iLet system does not have any programmed manual settings. If there is no CGM connection to maintain its automation, the system will require a blood glucose value to be entered every 4 hours up to 72 hours and will then shut off completely if there is still no CGM connection.

t:slim X2 Mobi AID System

In July 2023, the FDA cleared the t:slim X2 Mobi AID system, which uses the same control algorithm found in in the previously approved t:slim X2 With Control IQ Technology system.

The Mobi system is the smallest AID device available to date (13), at less than half the size of the previously approved t:slim AID system. It can hold up to 200 units of insulin.

This system has inductive charging and is capable of wireless remote software updates from a compatible smartphone. It can only be controlled by its smartphone app and has an on-pump button for quick boluses. It has 5-inch tubing and an optional wearable sleeve to hold the pump.

Conclusion

As the field of diabetes technology continues to advance rapidly and the use of technology has become a standard of care for insulin-requiring diabetes, health care professionals' needs for information and guidance have also increased (14–16). The members of ADA's interest groups provide support through various resources, including webinars, online forums, networking sessions, and publications.

Early initiation of diabetes technology is a game-changer in the management of children and adults with type 1 diabetes (17–19). People who initiate diabetes technology—and especially CGM—in the first year after their type 1 diabetes diagnosis have been found to have significantly lower A1C and better CGM-derived glycemic metrics throughout the ensuing years (17,19). The use of technology also improves glycemic outcomes and decreases diabetes burden (20,21). The activities and resources available through the ADA-DT-IG can aid in efforts to increase the quality of care and expand the appropriate use of technology among people with diabetes.

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AUTHORS CONTRIBUTIONS

H.K.A. wrote the initial draft of the manuscript. All members of the ADA-DT-IG leadership group reviewed and edited the manuscript and approved the final version for submission. H.K.A. is the guarantor of this manuscript and, as such, had full access to all the data in the manuscript and takes responsibility for the integrity of the content.

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