
بسم الله الرحمن الرحیم

6th International and 8th Iranian Congress of Endocrinology & Metabolism Updates

Vice Chancellery for Research

FARIR TEB

پیشرو در تکنولوژی‌های دیابت

فریر آسا طب

22 May 2025

Hot From the Oven:

Technology In Diabetes Care

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Gabric Diabetes Education Association

Isfahan, Iran

Disclosures

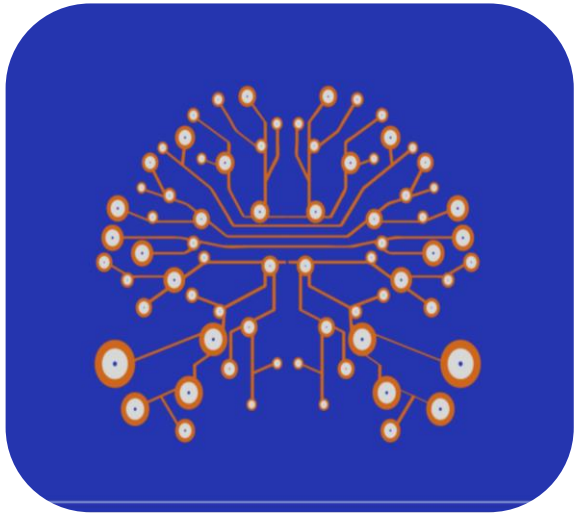
Seyed Adel Jahed has received honoraria for lectures or as consultant taking part in advisory board meetings from:

- Abidi
- Merck
- Roche
- Sanofi
- Eli Lilly
- Servier
- Actoverco
- Darman Yab
- Medtronic
- AstraZeneca
- FarirAsa Teb
- Pooyesh Darou
- Vitane Pharmed
- Koushan Pharmed
- Novo Nordisk Pars
- Boehringer Ingelheim

- I am a regular CGM user (Abbott, Sibionics)

Agenda

- Continues Glucose Monitoring (CGM)
- Continues Ketone Monitoring (CKM)
- Connected insulin delivery devices: Pen/Caps/Clips
- Diabetes management application
- Automated insulin delivery systems



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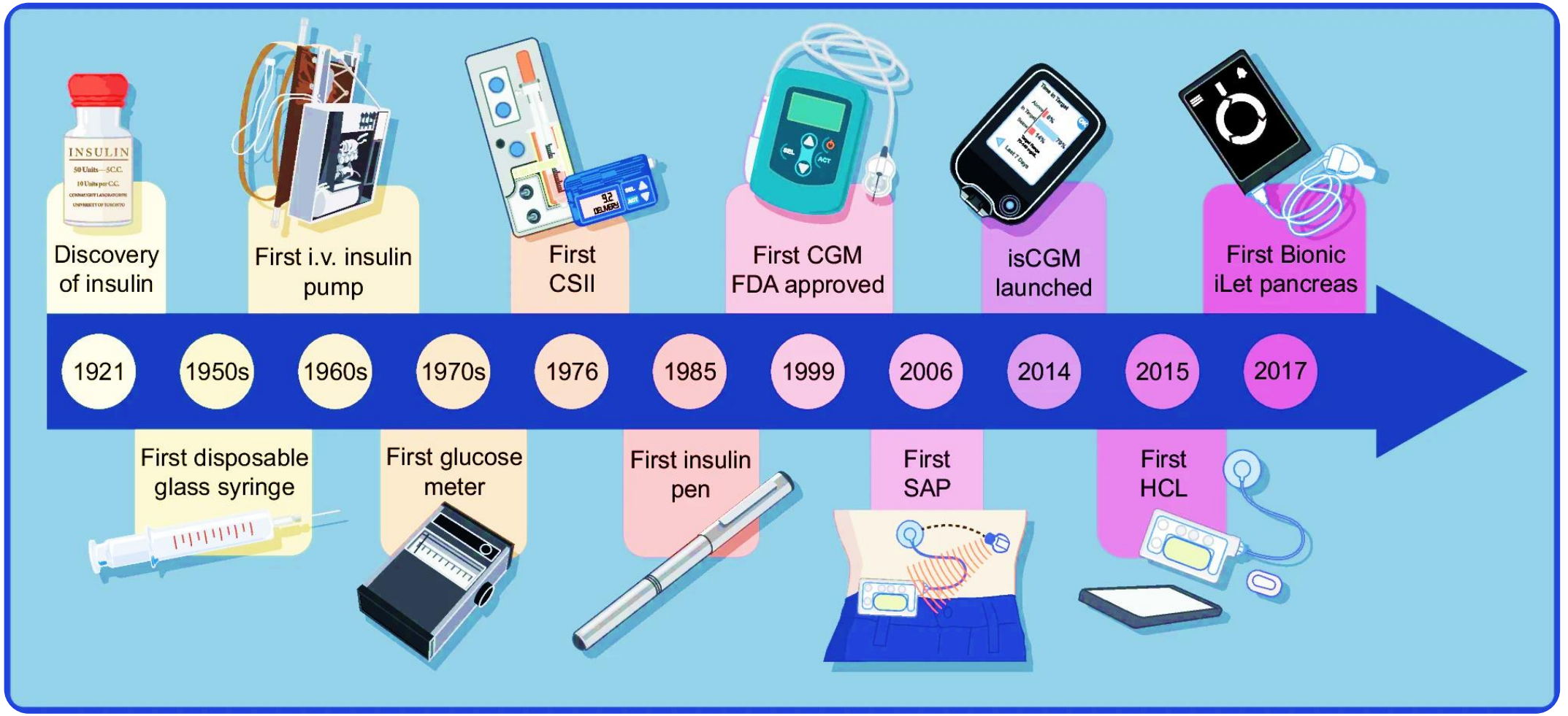
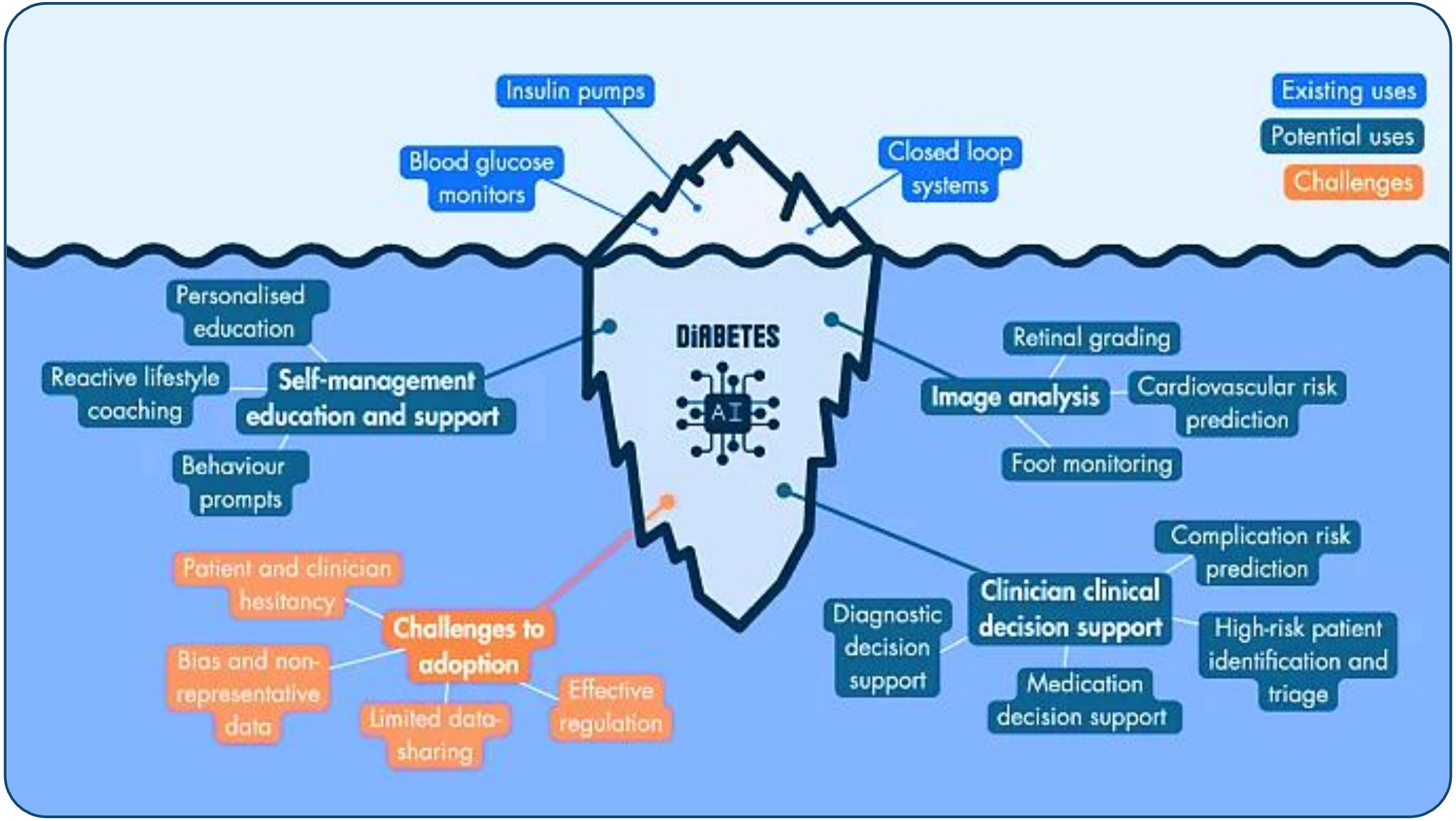
The Development of Diabetes Technology

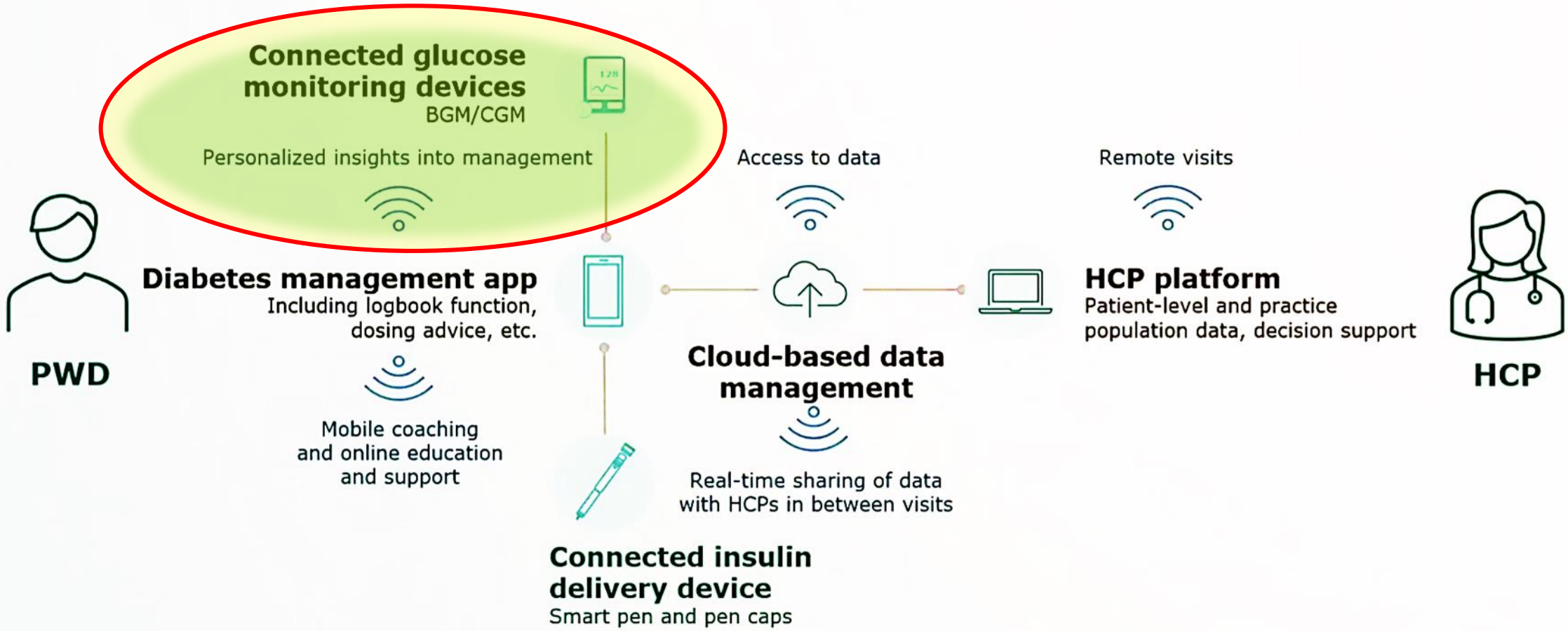


Mallik, R., et al.. *Diabetologia* **67**, 2019–2026 (2024).



Mackenzie, S.C. et al. *Diabetologia* 67, 223–235 (2024).

Digital solutions are playing an increasingly central role in diabetes management



Klonoff DC and Kerr D. J Diabetes Sci Technol 2018;12:3–6; Kerr D, et al. Endocr Pract 2023;29:179–84;
Hsu WC, et al. Diabetes Technol Ther 2016;18:59–67; Salari R, et al. J Med Internet Res 2021;23:e18167; Kumar PJ, et al. IOSR J Comput Eng 2015;17:109–17.

New means of control
Continues Glucose Monitoring (CGM)

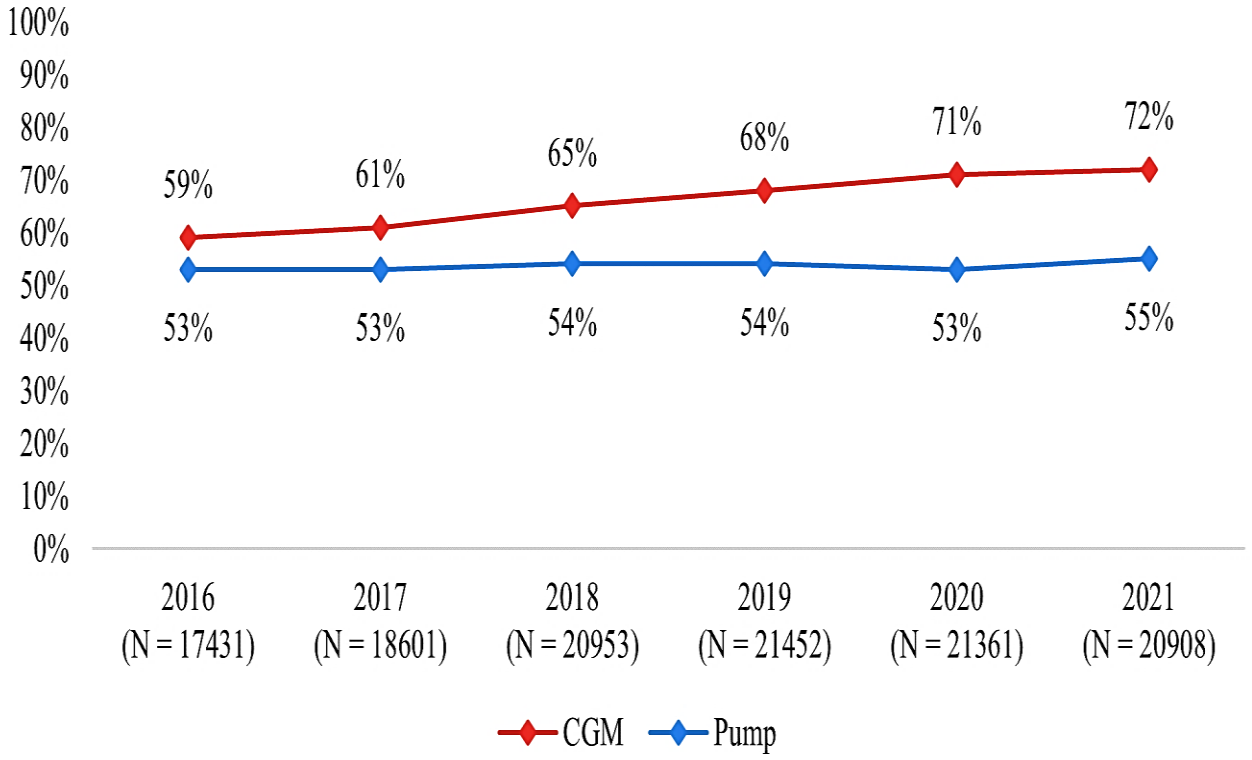

dexcom

Available CGMs

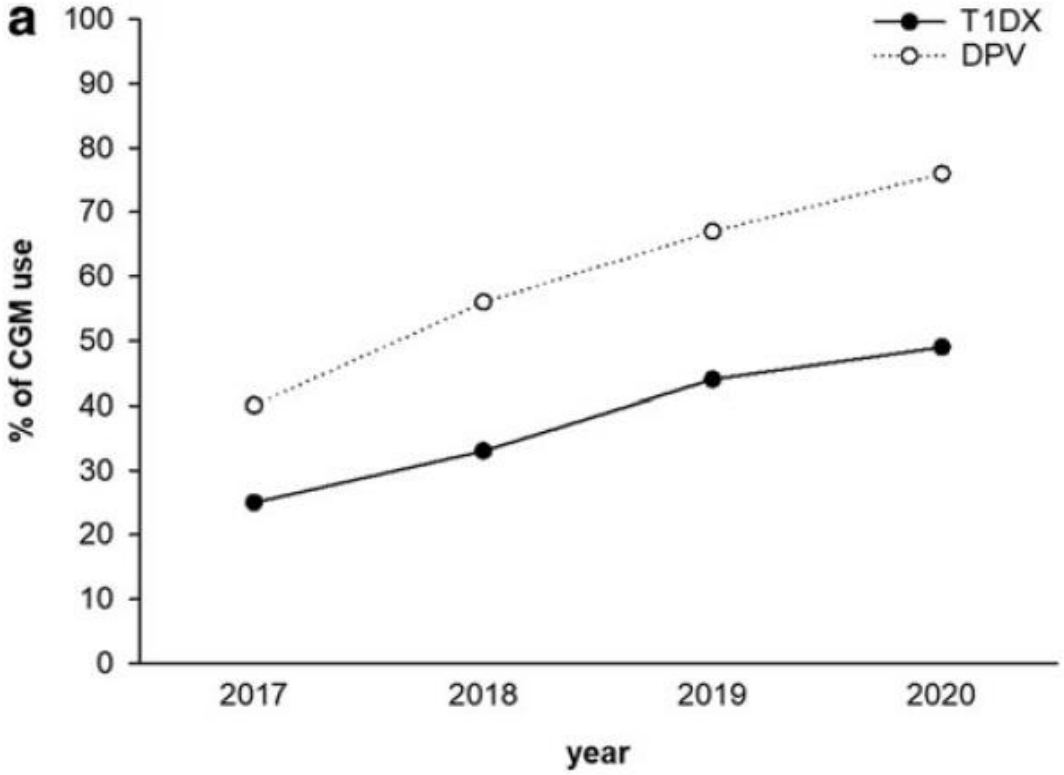
More than 47 CGMs available worldwide

Trend in CGM Use

From: **911-P: Longitudinal Trends in CGM and Pump Use: Real-World Data from the T1D Exchange QI Collaborative**



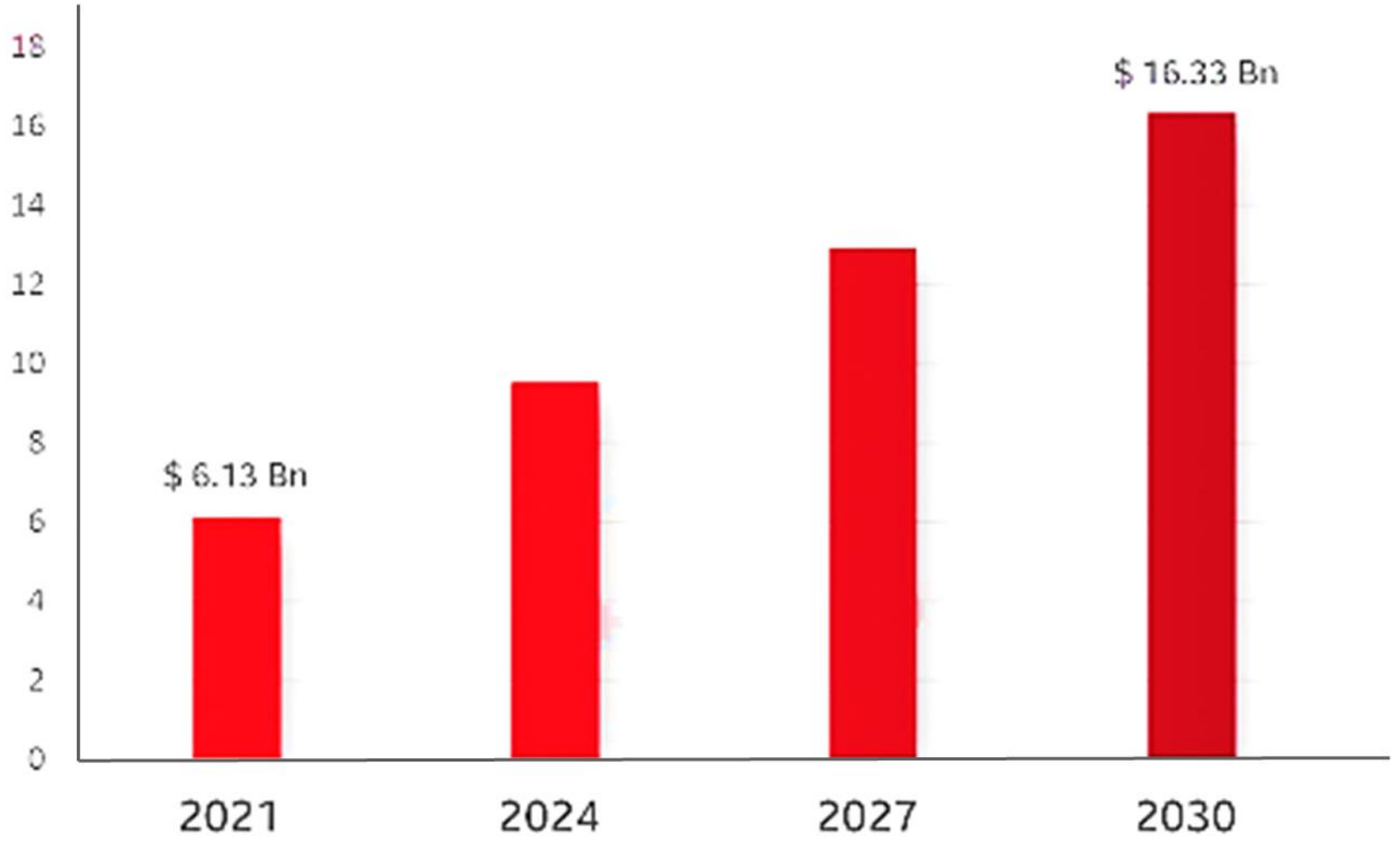
Diabetes. 2022;71(Supplement_1). doi:10.2337/db22-911-P



DeSalvo DJ, et al. *DIABETES TECHNOLOGY & THERAPEUTICS*. 2022; 12:920-24. DOI: 10.1089/dia.2022.0248

Global CGM devices market research (2021-2030)

Most aggressive growth forecast of 11.5% (USD Billion)



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Is Donald Trump still the hot topic?

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Intermittently Scanned CGM (isCGM)

American Diabetes Association. Connected for Life

isCGM devices should be **scanned frequently**, **at minimum once every 8 h**, to avoid gaps in data.

FreeStyle Libre

is-CGM without Alarms

FreeStyle Libre 2

is-CGM With Alarms

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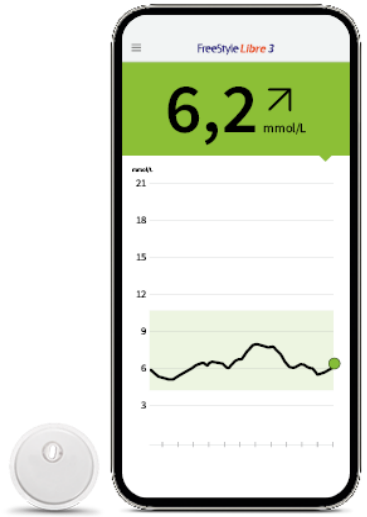
Real Time CGMs

FreeStyle Libre 3



dexcom

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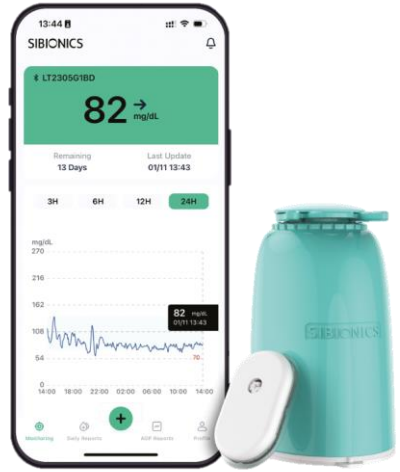

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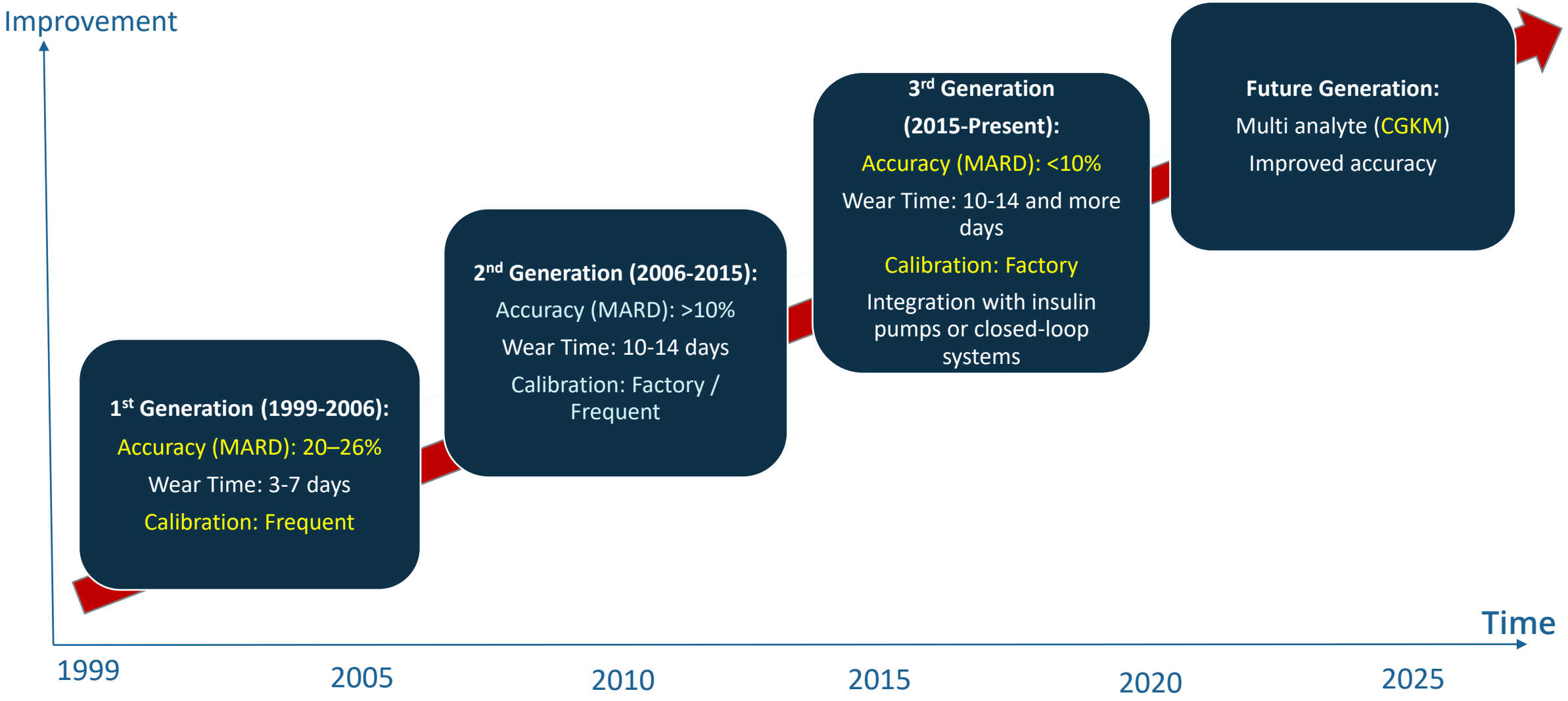
CGM History



Integrated CGM (iCGM)

As defined by the FDA, iCGM systems “are designed to reliably and securely transmit glucose measurement data to digitally connected devices, including automated insulin dosing systems.”

Bailey TS, Alva S. Diabetes technology & therapeutics. 2021 Sep 1;23(S3):S-5.

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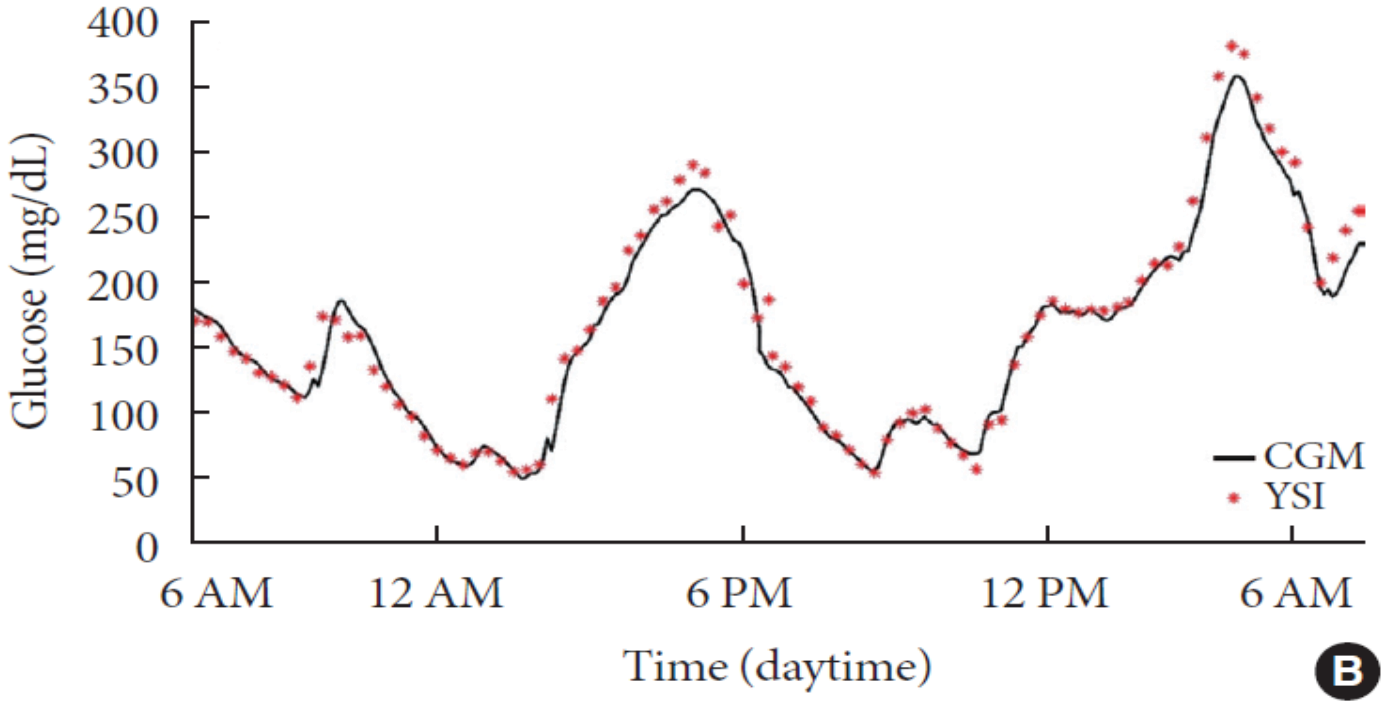
Accuracy

The mean absolute relative difference **(MARD)**

- Currently the most common metric used to assess the performance of CGM systems.
- MARD is the average of the absolute error between all CGM values and matched reference values.



International consensus on use of continuous glucose monitoring. Diabetes care. 2017;40(12):1631-40.
Continuous glucose monitoring sensors for diabetes management: A review of technologies and applications. Diabetes & metabolism journal. 2019;43(4):383-97.

Integrated CGM accuracy Criteria

Table 1. Measurement Accuracy Criteria of ISO 15197:2013 and FDA Requirements for Integrated CGM (iCGM) Systems.

Glucose concentrations	ISO 15197:2013	FDA's iCGM requirements[b]
Overall	≥ 95% within ±15 mg/dl or ±15%[a]	>87% within ±20%
<70 mg/dl	NA	>85% within ±15 mg/dl >98% within ±40 mg/dl no value >180 mg/dl
70-180 mg/dl	NA	>70% within ±15% >99% within ±40%
>180 mg/dl	NA	>80% within ±15% >99% within ±40% no value <70 mg/dl
Additional requirements	≥ 99% of within consensus error grid zones A and B	≤ 1% of glucose rates of change >1 mg/(dl*min) if true rate of change <–2 mg/(dl*min) ≤ 1% of glucose rates of change <–1 mg/(dl*min) if true rate of change >2 mg/(dl*min)

Journal of Diabetes Science and Technology. 2019;13(3):575-583

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American Diabetes Association
ISSN 0149-5992

Check for updates

7. Diabetes Technology: Standards of Care in Diabetes—2025

*American Diabetes Association Professional Practice Committee**

Diabetes Care 2025;48(Suppl. 1):S146–S166 | https://doi.org/10.2337/dc25-S007

Recommendations

7.15 Recommend real-time CGM (rtCGM) **A** or intermittently scanned CGM (isCGM) for diabetes management to youth **C** and adults **B** with diabetes on any type of insulin therapy. The choice of CGM device should be made based on the individual's circumstances, preferences, and needs.

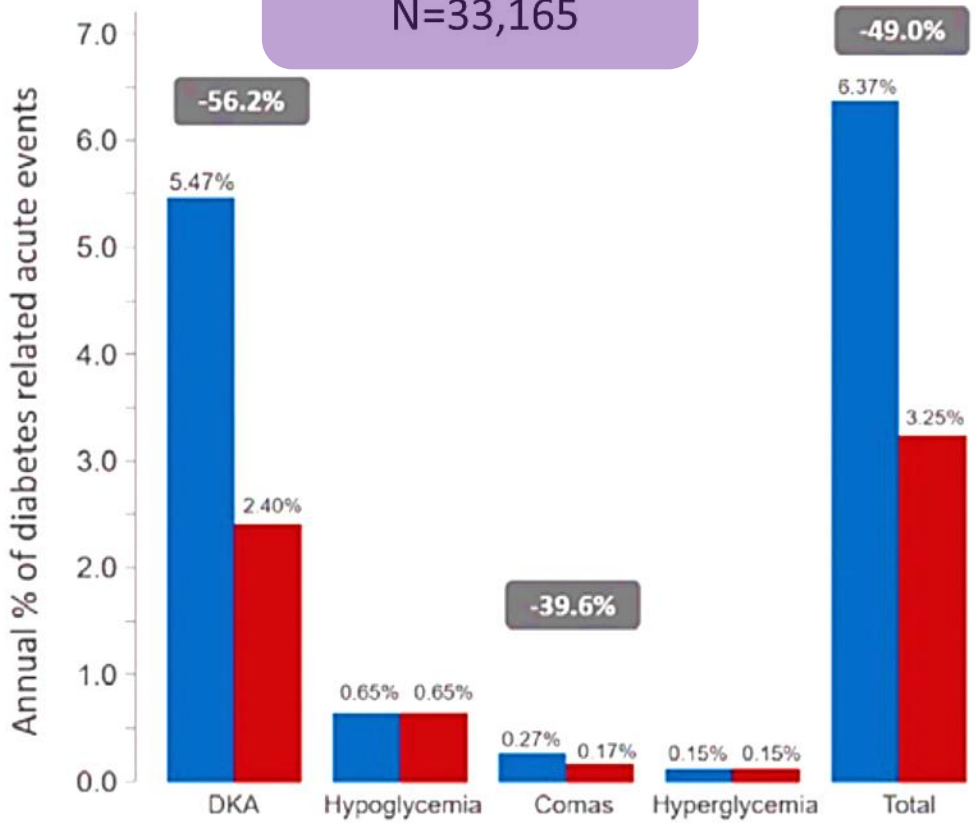
CGMS

Outcomes/efficacy

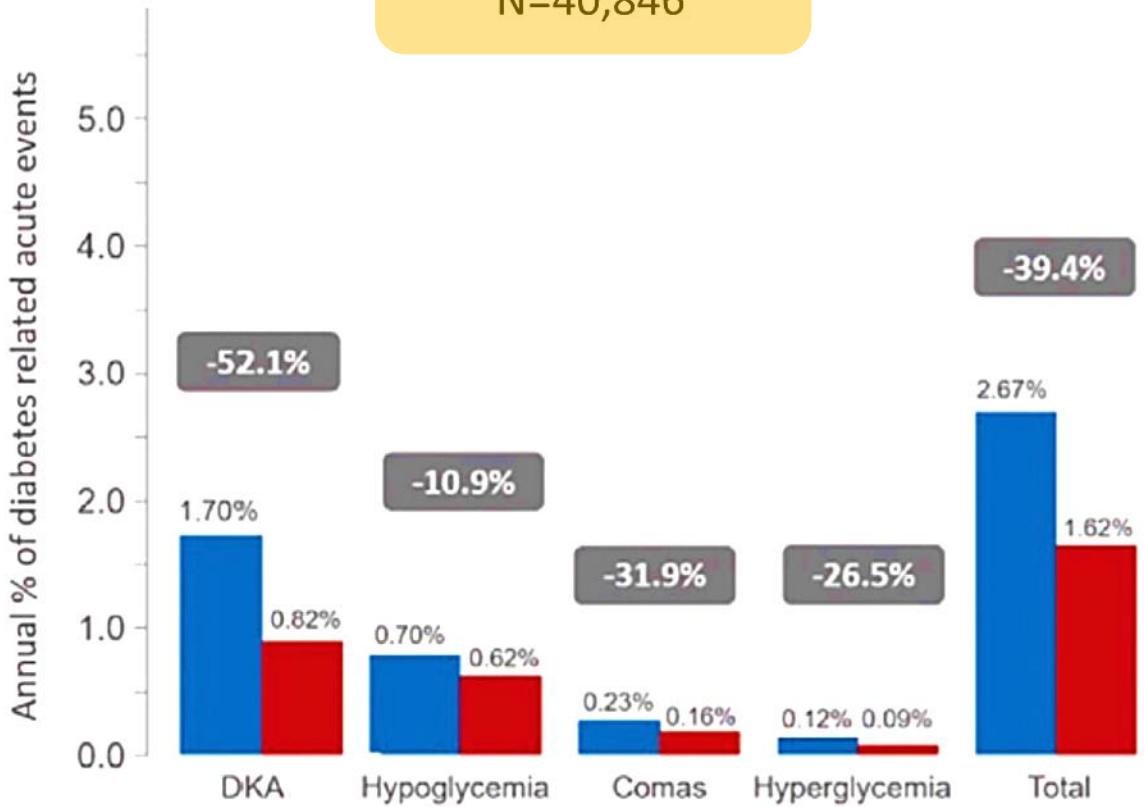
Recommendations

RELIEF study, MDI, France

A Type 1 diabetes
N=33,165



B Type 2 diabetes
N=40,846



Roussel et al. *Diabetes Care* 2021;44:1-9

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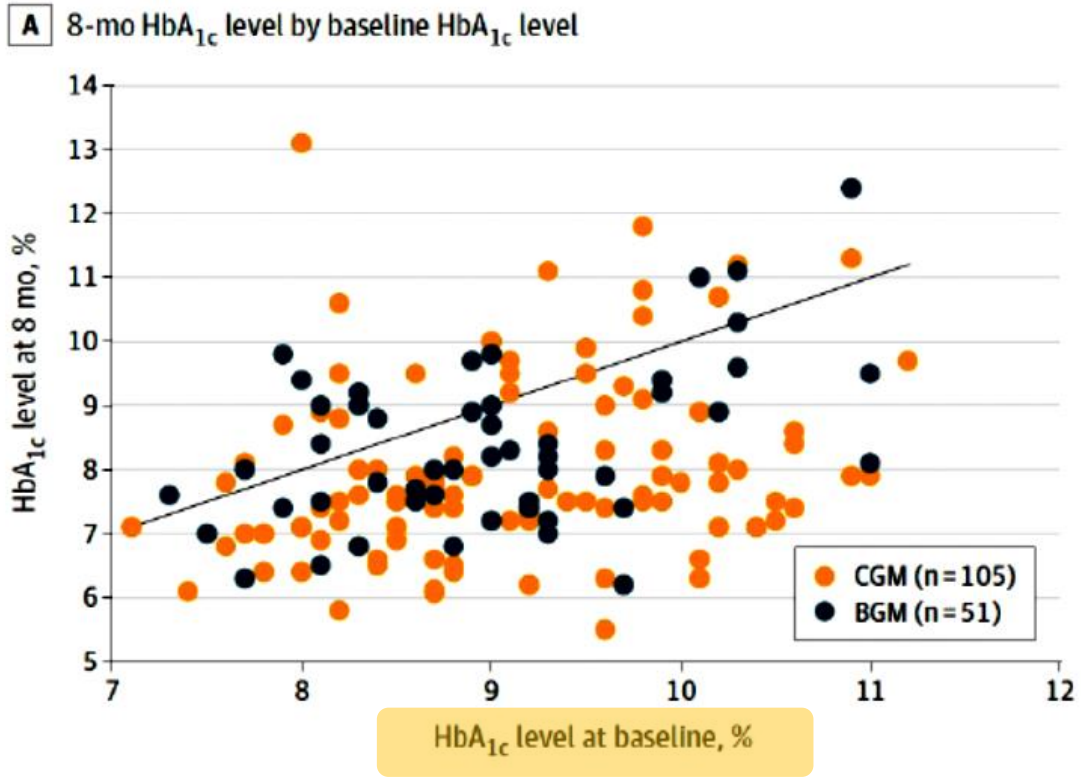
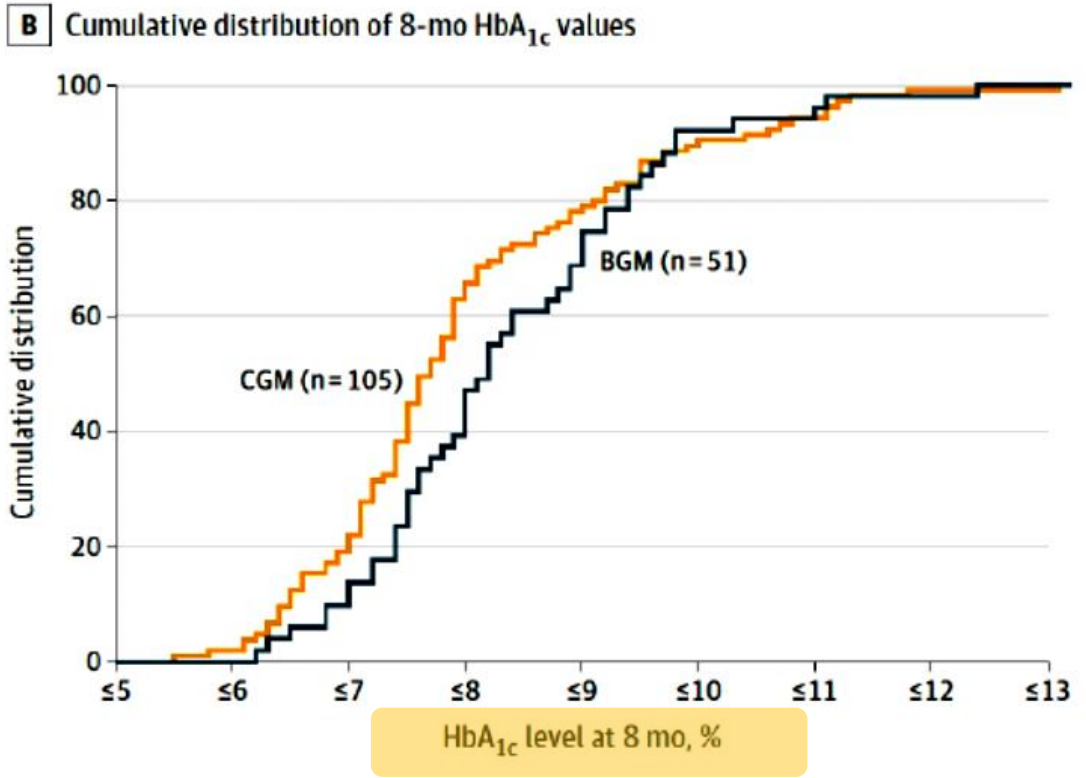
JAMA | Original Investigation

Effect of Continuous Glucose Monitoring on Glycemic Control in Patients With Type 2 Diabetes Treated With Basal Insulin

A Randomized Clinical Trial





Mean difference was -0.4% HbA1c

Martens et al. *JAMA* 2021;325(22):2262-72.

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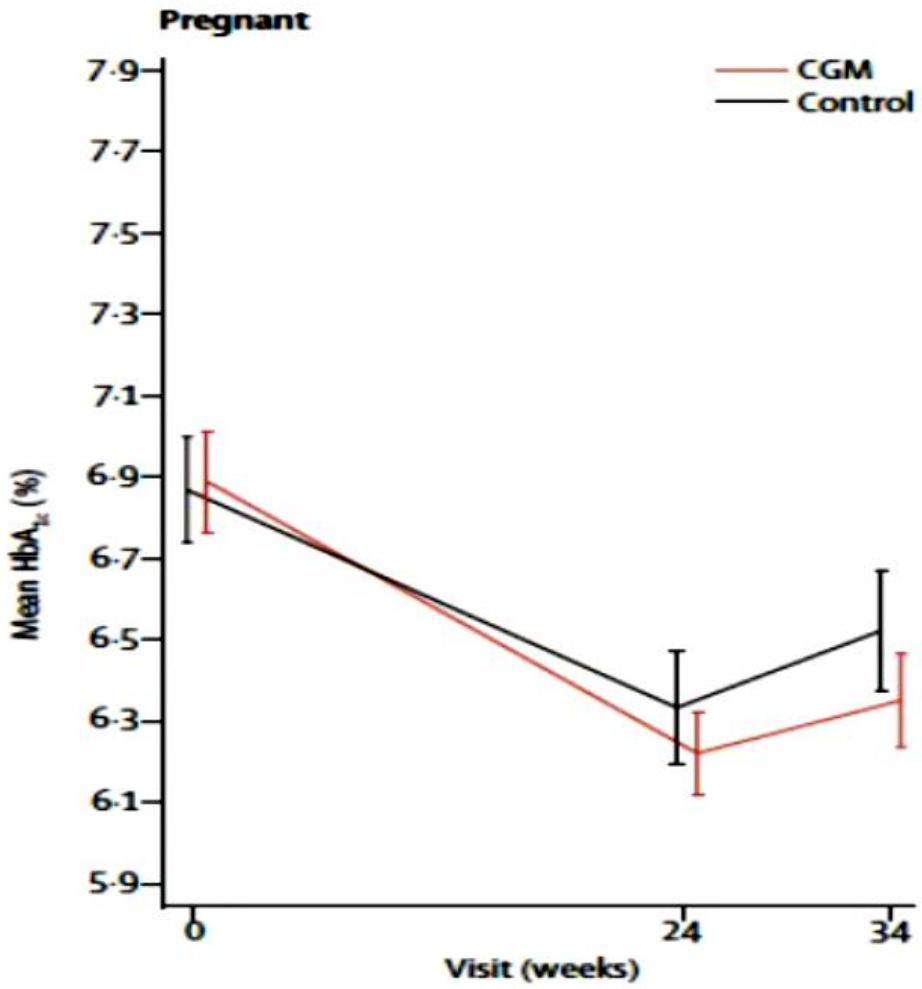
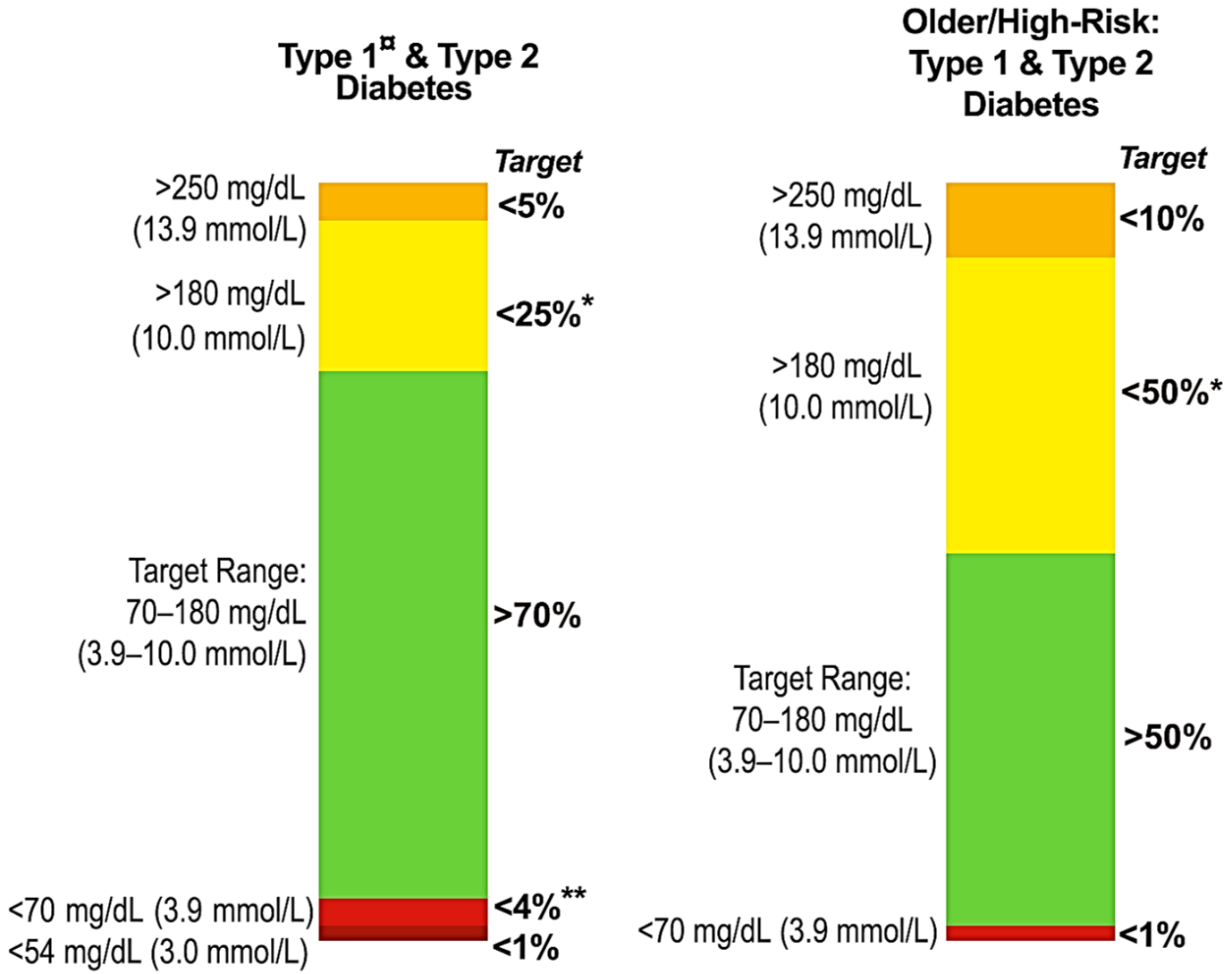
Continuous glucose monitoring in pregnant women with type 1 diabetes (CONCEPTT): a multicentre international randomised controlled trial



	CGM	Control
Stillbirth	0	1
Congenital Anomaly	2	3
Early preterm < 34 weeks	5%	7%
LGA > 90%	53%*	69%
Macrosomia > 4000g	23%*	27%
NICU > 24 hrs	27%*	43%

Feig et al. *Lancet* sept 2017

CGM-based targets for different diabetes populations



Clinical targets for continuous glucose monitoring data interpretation: recommendations from the international consensus on time in range. Diabetes Care. 2019;42(8):1593-603.

New metrics beyond TIR:

TITR, TING

New means of control
Continues Ketone Monitoring (CKM)

Unmet need for continuous ketone monitoring in diabetes

Original Article

Journal of Diabetes Science and Technology
2021, Vol. 15(4) 775–780

DOI: 10.1177/19322968211009860
journals.sagepub.com/home/dst
SAGE

Continuous Ketone Monitoring: A New Paradigm for Physiologic Monitoring

Jennifer Y. Zhang, BA[1], Trisha Shang, BA[1], Suneil K. Koliwad, MD, PhD[2], and David C. Klonoff, MD, FACP, FRCP (Edin), Fellow AIMBE[3]

Abstract

In this issue of JDST, Alva and colleagues present for the first time, development of a continuous ketone monitor (CKM) tested both in vitro and in humans. Their sensor measured betahydroxybutyrate (BHB) in interstitial fluid (ISF). The sensor was based on wired enzyme electrochemistry technology using BHB dehydrogenase. The sensor required only a single retrospective calibration without a need for further adjustments over 14 days. The device produced a linear response over the 0-8 mM range with good accuracy. This novel CKM could provide a new dimension of useful automatically collected information for managing diabetes. Passively collected ISF ketone information would be useful for predicting and managing ketoacidosis in patients with type 1 diabetes, as well as other states of abnormal ketonemia. Although additional studies of this CKM will be required to assess performance in intended patient populations and prospective factory calibration will be required to support real time measurements, this novel monitor has the potential to greatly improve outcomes for people with diabetes. In the future, a CKM might be integrated with a continuous glucose monitor in the same sensor platform.

J Diabetes Sci Technol. 2021 Jul;15(4):775-780. doi: 10.1177/19322968211009860

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Unmet need for continuous ketone monitoring in diabetes

- CKM offers a **paradigm shift** from diabetes management focused solely on glucose as an analyte of interest to a **multianalyte approach**

Measurement of ketones can be helpful to assess :

- Compliance with low carbohydrate diet
- Assessment of acidosis associated with alcohol use
- In conjunction with SGLT2 inhibitors and immune checkpoint inhibitor therapy, both of which can increase the risk of DKA;
- To identify DKA due to insulin deficiency

Journal of Diabetes Science and Technology. 2023;18(3):714-726. doi:10.1177/19322968231152236

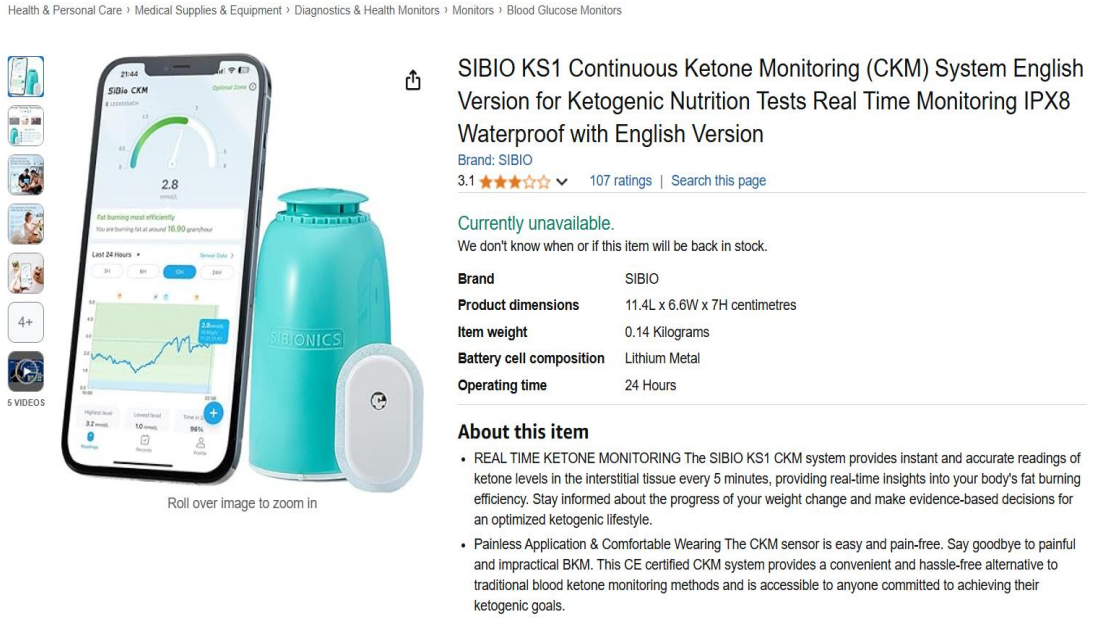
CKM: It is real!

Not approved for diabetes! The approval is for Ketogenic diet

Check real-time

We have got you covered

- 14-Day Real-Time Ketone Monitoring
- Precise Data Measurement
- Insightful Trends



https://www.sibiosensor.com/

https://www.amazon.de/-/en/KS1-Continuous-Monitoring-Ketogenic-Waterproof/dp/B0CNV96WHW

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Received: 4 June 2024 | Revised: 9 August 2024 | Accepted: 20 August 2024
DOI: 10.1111/dom.15921

SPECIAL ISSUE ARTICLE

WILEY

Continuous ketone monitoring: Exciting implications for clinical practice

Yee Wen Kong MBBS[1] | Dale Morrison PhD[1] | Jean C. Lu MBBS[1,2] | Melissa H. Lee PhD[1,2,3] | Alicia J. Jenkins MD[1,2,4,5] | David N. O'Neal MD[1,2,3,4]

TABLE 2 Proposed responses to continuous ketone monitor thresholds.

	Acceptable	Elevated	High	Very high
Ketone (mmol/L)	< 1.0	1.0-1.5	1.6-3.0	> 3.0
Response	• No action • (Correct high glucose)	• No action • Observe trends • (Correct high glucose) • Review in 2 h	• Check insulin delivery • If missed insulin dose administer now • Consider hydration • Correct high glucose (eat) • Review in 1 h • Observe trends	• Check insulin delivery/change set • If missed insulin dose administer now • Correct high glucose with pen (eat) • Seek medical help • Hydrate now • Review in 1 h

Note: The colours in the table correspond to the colours in Figures 3 and 4 relating the ketone ranges, urgency, and suggested responses to the proposed display of ketone data in real time and post-upload for retrospective review.

Diabetes Obes Metab. 2024 Dec;26 Suppl 7(Suppl 7):47-58. doi: 10.1111/dom.15921.

Breakthrough T1D™
Formerly JDRF

Thomas Danne • 1st
Chief Medical Officer International, Breakthro...
1mo •

International Consensus on Continuous Ketone Monitoring (#CKM) meeting organised by Breakthrough T1D during #ATTD2025. Diabetic ketoacidosis (#DKA) is one of the most preventable causes of morbidity and mortality for people with diabetes. The emerging availability of CKM technology will provide an option to reduce risk and prevent DKA. Once published this CKM Consensus may guide Health Care Professionals and support clinical adoption of such devices once they become available. Thank you Rich Bergenstal Professor Ketan Dhatariya Anastasia Albanese-O'Neill Rob Brines chantal mathieu Tadej Battelino Jennifer Sherr, MD, PhD Lori Laffel Eden Miller Davida Kruger Carol Wysham Kirsten Nørgaard Moshe Phillip Mohammed Al-Sofiani Mauro Scharf David O'Neal Sanjoy Dutta Jonathan Rosen Kelly Close Rodolfo Galindo Julianne Lally, DMSc, MHS, PA-C Tal Oron Amin GhavamiNejad Monica Oxenreiter Jessie Kohn Takata Julie (Keller) Heverly David Maahs Claudio Maffeis Rimei Nishimura

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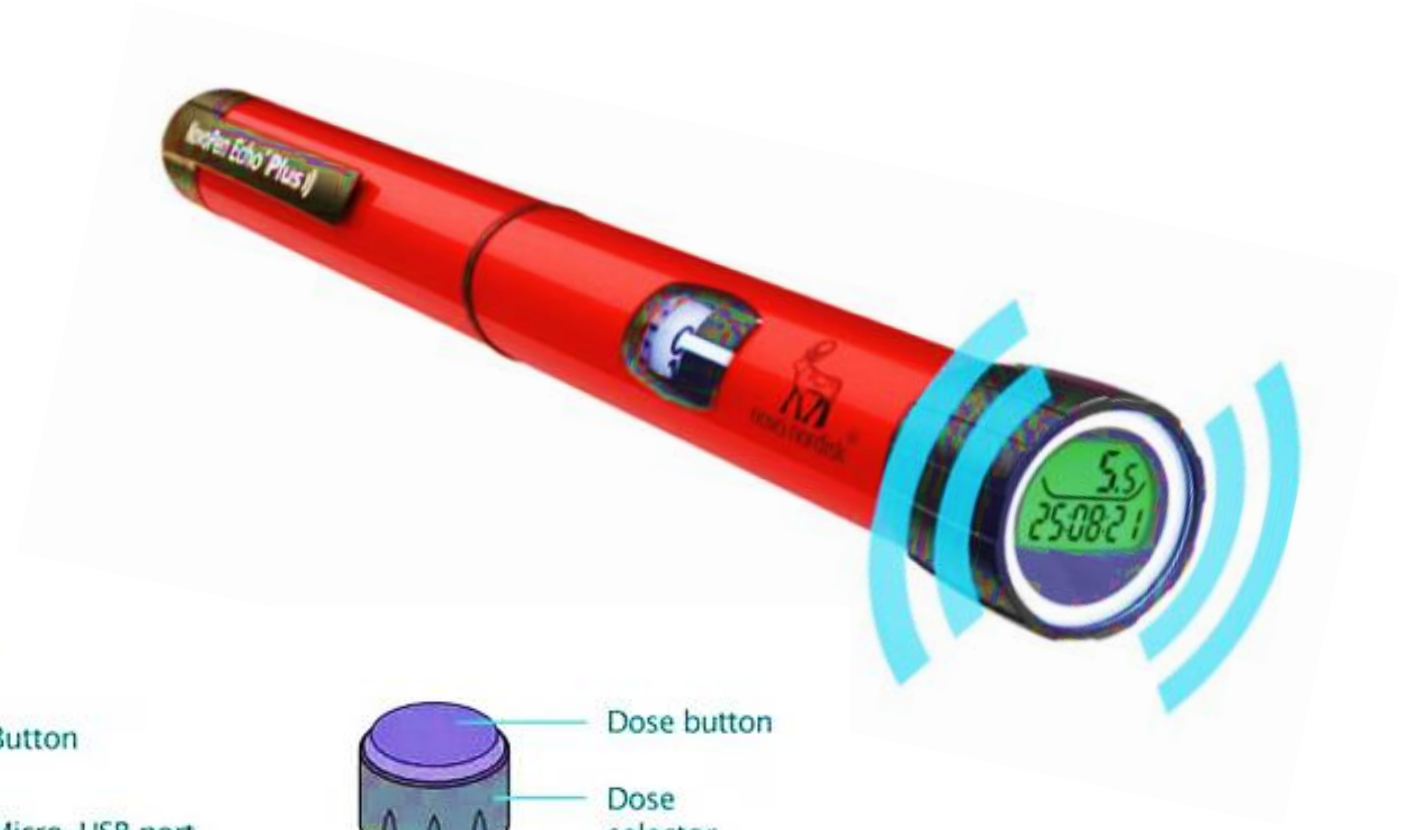
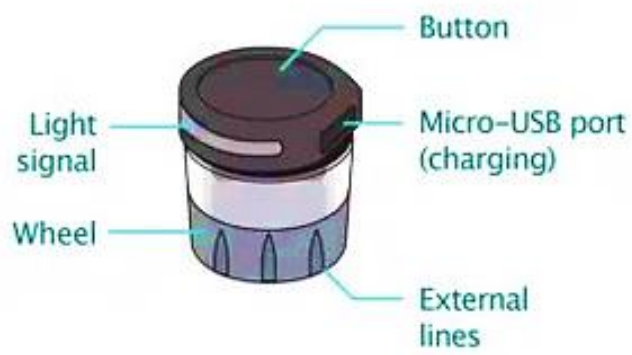
Connectivity in delivery systems in diabetes

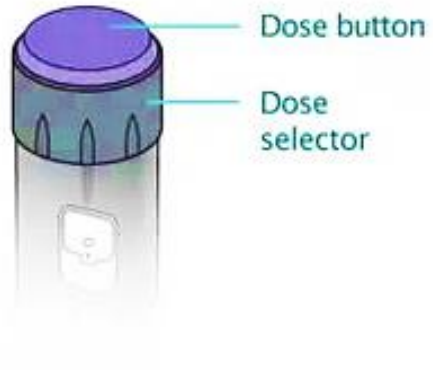
You will not forget



Conhecendo o SoloSmart e a caneta



SoloSmart



Sanofi SoloStar® insulin pen

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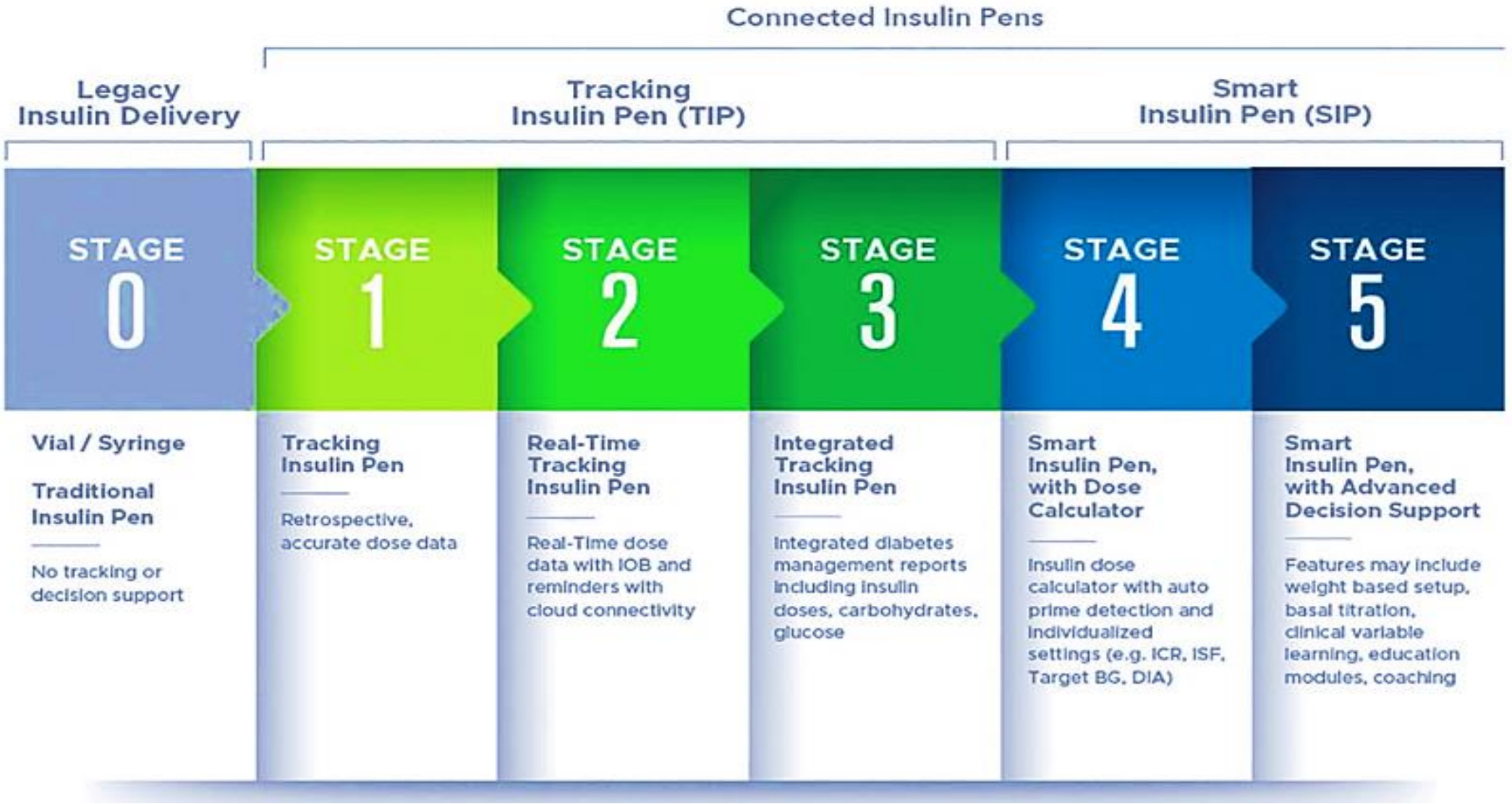
Connected insulin pen development



DIABETES TECHNOLOGY & THERAPEUTICS Volume 26, Number 1, 2024 Mary Ann Liebert, Inc. DOI: 10.1089/dia.2023.0365

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Current and future solid smart insulin pens and pen caps

Smart Insulin Pens	InPen	Novopen 5 & Novopen Echo	Novopen 6 & Novopen Echo plus	Pendiq 2,0	Bigfoot Unity	Dukada Trio	Dukada Smart Cap
Photo							
Company	Medtronic (USA)	Novo Nordisk (Denmark)	Novo Nordisk (Denmark)	Diamesco (Korea)	Bigfoot Biomedical (USA)	Dukada (Denmark)	Dukada (Denmark)
Available	Yes (≥ 7 years)	Yes	Yes	Yes (Germany)	Yes in US (≥ 12 years old)	Yes (Amazon)	In development
Type of pen	Fixed pen	Fixed pen	Fixed pen	Fixed pen	Pen cap	Pen cap	Pen cap
Price	665 USD	84 usd	50 euros	169 euros	Sold together with sensors	39 euros	?
Battery	1 year, not rechargeable or replaceable	5 years, not rechargeable or replaceable	5 years, not rechargeable or replaceable	Rechargeable battery via USB	Rechargeable battery (lasts several weeks)	Replaceable cell battery Renata 380 (after 6-8 months)	?
Insulin	Novorapid, Humalog, Fiasp (short-acting insulin only!)	Novorapid, Fiasp, Levemir, Tresiba	Novorapid, Fiasp, Levemir, Tresiba	All insulins (Penfill)	All insulins (white cap for short-acting insulin, black cap for long-acting)	Flexpen, Solostar	"different pens"
Platform	Inpen app	/	Glooko, MySugr, Libreview	Diabetes Management app	Bifoot Unity app	/	Dukada DNV Logbook app
CGM	Guardian 3 (US), Guardian 4 (EU)	/	Libre, Dexcom through Glooko	/	Libre	/	/
Features	Tracks insulin timing, dose and temperature, integrated bolus calculator, recognizes "priming", shows insulin on board, missed bolus alarm	Shows last insulin dose and time since last dose on the pen	Tracks and shows last insulin dose and time since last insulin dose on pen cap and after NFC scanning also in Mysugr, Glooko app or Libreview/LibreLink	Tracks insulin timing and dose and displays on pen, has low battery / needle blocked / low insulin alert, data goes via Bleutooth to app or via USB to computer	Tracks insulin timing and temperature, scans Libre sensor, tracks and displays recommended insulin dose on cap, missed bolus alarm, mandatory alarm <54 mg/dL, optional alarm <70 mg/dL	Shows time since last dose on pen using 3 lights, low battery notification	Tracks and displays last insulin dose and time since last dose, data goes via Bluetooth to mobile phone. Also detects priming, has dose reminders and temperature alerts

Current and future smart insulin pen clips

Smart Insulin Pens	Mallya	Tempo Smart Button	SoloSmart Button	Insulclock	Clipsulin	GlucoMen Day PENCAP
Photo						
Company	Biocorp, taken over by Novo Nordisk	Lilly (USA)	Sanofi (France)	InsulCloud (Spain)	Glooko (USA) - used to be > Diabnext	Menarini (Italy) - used to be >Innovation Zed
Available	Yes	No (but CE label)	No (but CE label)	Yes (Spain)	Yes (Amazon)	No (CE&FDA label)
Type of pen	Pen clip (2 pieces)	Pen clip	Pen clip	Pen clip	Pen clip	Pen clip
Price	122 usd	Membership plan	?	249 euros	40 euros	34USD
Battery	Charge 1x/month (for 2 hours) via USB (2-year warranty)	8 months, not rechargeable or replaceable	Rechargeable battery via USB	Charge 1x/3 days (for 1.5 hours)	Replaceable cell battery CR2032 (1 year warranty)	Rechargeable battery via USB
Insulin	Kwikpen, Flexpen, Solostar, Flextouch	Tempo Pens for Abasaglar, Humalog, Lyumjev	Solostar	Kwikpen, Flextouch	All insulins	Kwikpen, Flexpen, Solostar, Novopen 4/5/Echo
Platform	Mallya app, Gluci-Check & RDCP (Roche), Glooko (+ Collaboration with Diabeloop & DreMed Advisor Pro)	TempoSmart app > Tempo Personalised Diabetes Managament Platform, Roche, Glooko, MySugr, myDiabby, WellDoc, Dexcom	Mallya app, Gluci-Check & RDCP (Roche), Glooko	Diabetes control - Insulclock app	Glooko	GlucoLog Lite app > GlucoLog web cloud
CGM	Dexcom via Glooko	Dexcom	Dexcom via Glooko	Dexcom	Dexcom through Glooko	GlucoMen Day CGM
Features	Tracks insulin timing, dose and type of insulin, integrated bolus calculator, clip shows battery status, data goes to app via Bluetooth	Tracks insulin timing, dose and type of insulin, get dose reminders, data goes to app via Bluetooth	Tracks insulin timing, dose and type of insulin, integrated bolus calculator, clip shows battery status, data goes to app via Bluetooth	Tracks insulin timing, dose, temperature, type of insulin and duration of insulin injection, data goes to app via Bluetooth, missed bolus alarm	Tracks insulin timing and dose via audible clicks of insulin pen, data goes to app via Bluetooth or NFC, low battery notification	Tracks and displays insulin dose and time since last injection on cap, notifies low battery, low/high temperature (no bolus calculator)

Connectivity Solutions

Smart insulin caps	SoloSmart Button	Tempo Smart Button	Dialoq
Picture			
Firm	Sanofi	Lilly	Novo Nordisk
Fits on	Solostar	Tempopen	FlexTouch
Approval	CE-label	CE- an FDA-label verwacht eind 2022	?
Dedicated app	yes: Mallya app	yes	no
Sends data to	Gluci-Check & RDCP, YourLoops?	MySugr, RDCP, Glooko, MyDiabby, Welldoc, Dexcom	MySugr, Glooko, Libreview from summer 2022?
Battery	Rechargeable via USB	1 year warranty	?

Association Between Treatment Adherence and CGM Outcomes in PWD Using Smart Insulin Pens in a Real-World Setting

METHODS

Retrospective real-world analysis of observational data[a] from **3,945** adults with diabetes[b] from **16 countries** (**Europe** and **Japan**) self-administering basal[c] and bolus[d] insulin using a smart insulin pen (NovoPen 6 or NovoPen Echo Plus) alongside CGM.[e]

Treatment adherence and **smart insulin pen engagement** were assessed over 14-day periods through **missed basal**[f] and **missed bolus**[g] insulin doses, and **frequency of data uploads**.[h]

RESULTS

Mean frequency (number) and estimated probability (%) of occurrence over a 14-day period

Missed basal insulin doses: 0.19
Missing ≥ 1 basal dose: 17.6% (95% CI: 16.5%, 18.7%)

Missed bolus insulin doses: 6.0
Missing ≥ 1 bolus dose: 99.1% (95% CI: 98.7%, 99.4%)

Over a 14-day period, one **missed basal** insulin dose or one **missed bolus** insulin dose was associated with:

- a significant decrease in the percentage of TIR (3.9–10.0 mmol/L) of **−2.8%** and **−1.7%**
- a significant increase in GMI score of **+0.2%** and **+0.1%**

Smart insulin pen engagement was positively associated with glycemic outcomes.

- Over a 14-day period, 1 day with at least one data upload was associated with a significant increase (**+0.5%**) in percentage of TIR (3.9–10.0 mmol/L).

These data highlight the challenges of adhering to basal-bolus insulin treatment in a real-world setting. **Missing two basal or four bolus insulin doses** over a 14-day period was associated with a **clinically relevant decrease of > 5%** in the percentage of **TIR (3.9–10.0 mmol/L)**.

[a]Data collection period: March 23, 2021–July 8, 2023. [b]Consented to sharing anonymous data. [c]Insulin degludec. [d]Insulin aspart or fast-acting insulin aspart. [e]Data from smart insulin pens and CGM devices were aggregated into 14-day periods. [f]A missed basal insulin dose was defined as a window of > 40 h between two consecutive doses. [g]A missed bolus insulin dose was defined as a meal with no bolus insulin injection within the window of 15 min before to 1 h after the start of a meal, with meals detected from the CGM signal. [h]The number of days with a data upload was used as a proxy for smart insulin pen engagement. CGM, continuous glucose monitoring; GMI, glucose management indicator; SD, standard deviation; TBR, time below range; TIR, time in range.

Diabetes Care 2024;47(6):995–1003 | https://doi.org/10.2337/dc23-2176

Dexcom Smart Insulin Pens

☆☆☆☆☆

Smart Insulin Pen Dexcom

$69.88

☆☆☆☆☆

Smart Insulin Pen Dexcom

$69.88

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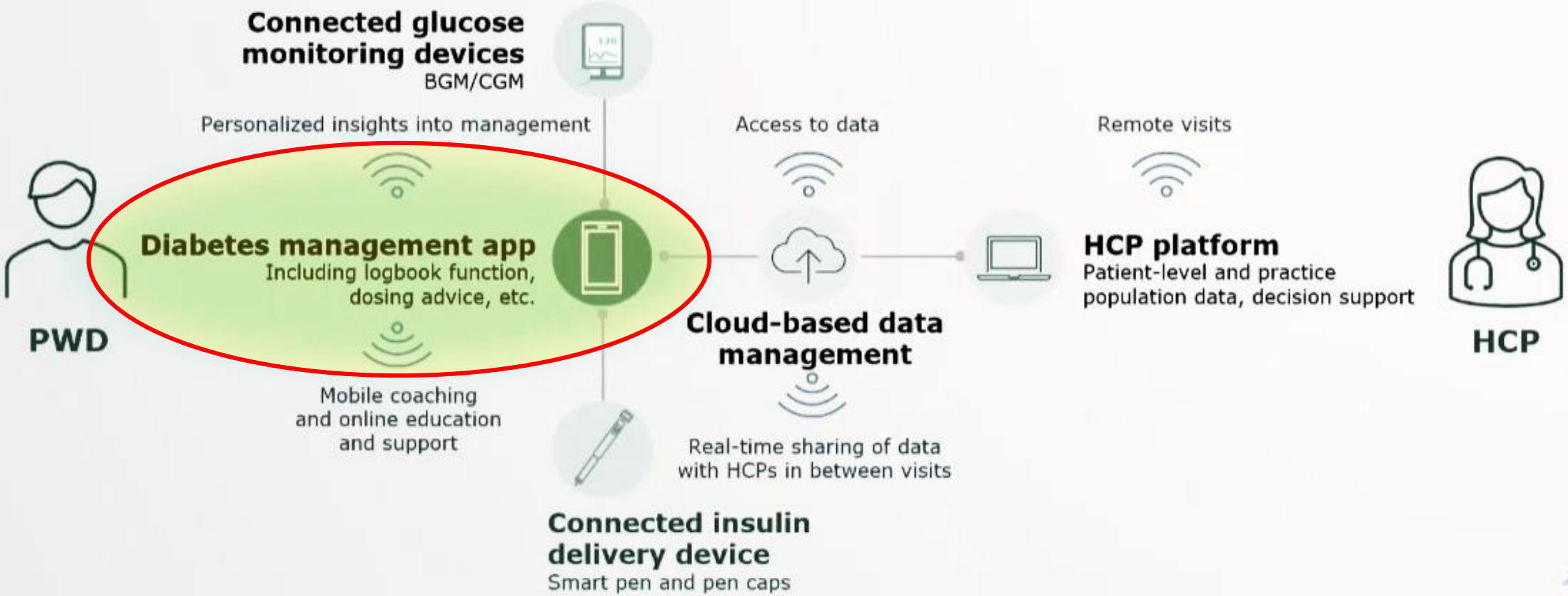
Smart Insulin Pen Dexcom

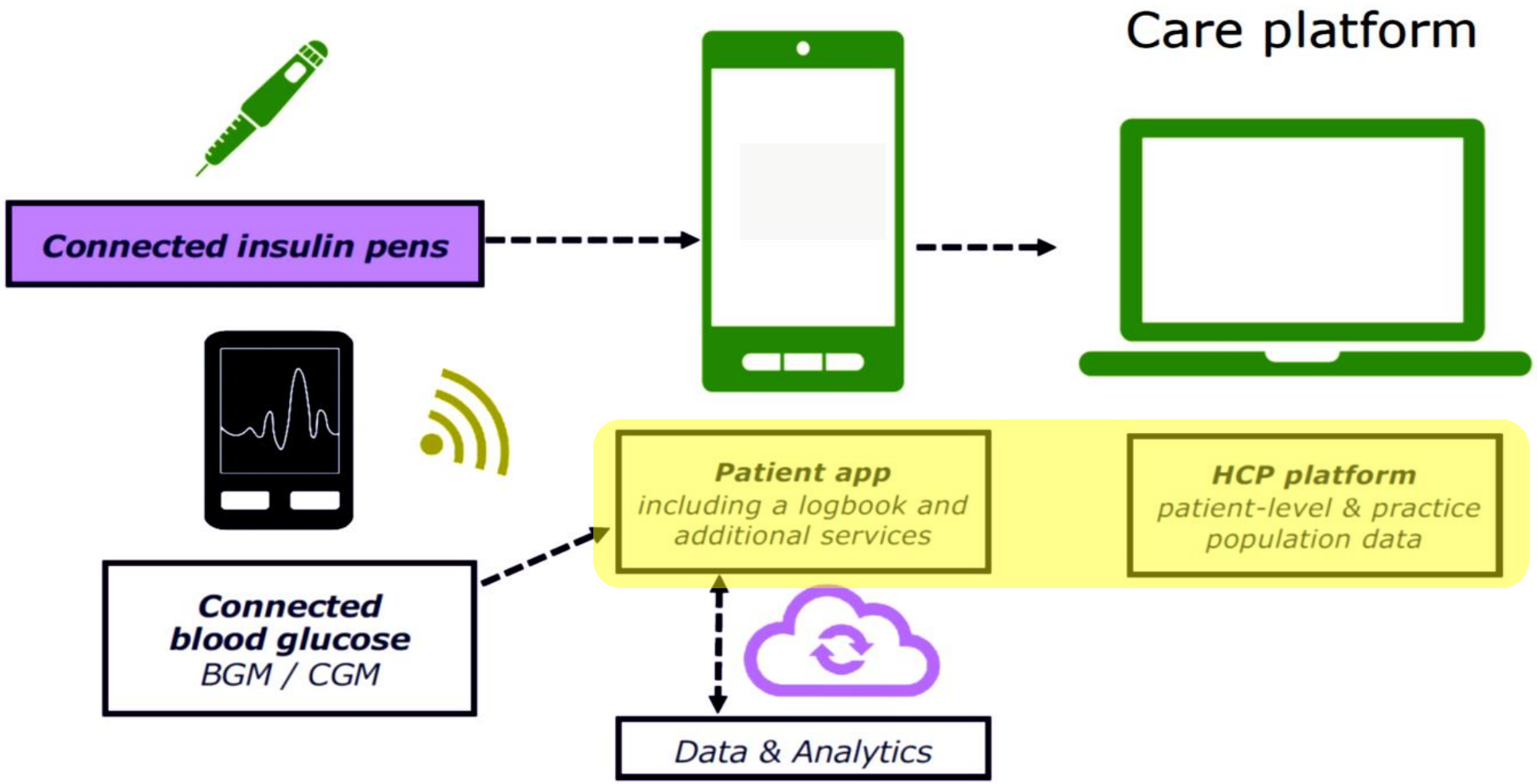
$69.88

Digital solutions are playing an increasingly central role in diabetes management



Klonoff DC and Kerr D. J Diabetes Sci Technol 2018;12:3–6; Kerr D, et al. Endocr Pract 2023;29:179–84;
Hsu WC, et al. Diabetes Technol Ther 2016;18:59–67; Salari R, et al. J Med Internet Res 2021;23:e18167; Kumar PJ, et al. IOSR J Comput Eng 2015;17:109–17.

Connected Pens and meters are enablers for data driven consultations → and possibly decision support systems



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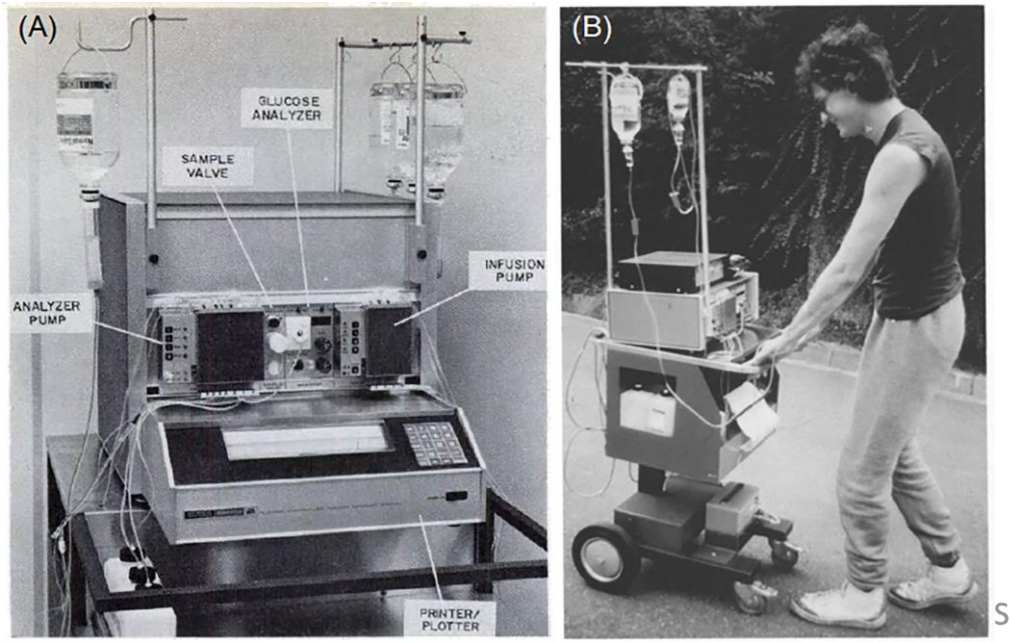
Automated Insulin Delivery Systems

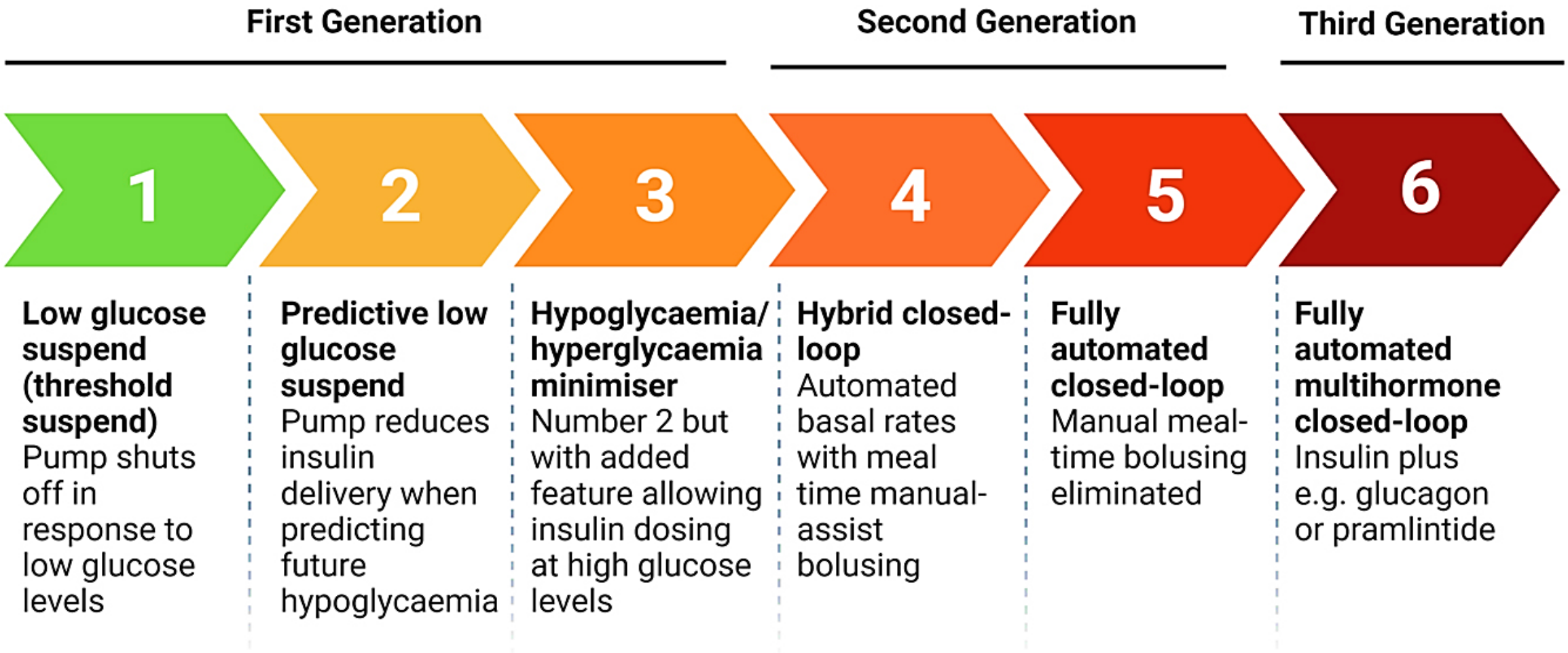
- The first intravenous AID system was developed in 1963 by Arnold Kadish . It comprised of an intravenous glucose monitor and two intravenous syringe pumps: a pump delivering insulin which was activated when glucose level rose above the higher threshold and a pump delivering either glucose or glucagon which was activated when glucose fell below the lower threshold. It never made it to market due to its impracticality, being the size of an army backpack

- Figure 2. Early automated insulin delivery systems (A) The first insulin pump, developed by Kadish. (B) The Biostator computer-based glucose-controlled insulin infusion system. Reproduced with permission from Alsaleh FM, Smith FJ, Keady S & Taylor KM, 'Insulin pumps: from inception to the present and toward the future', *Journal of Clinical Pharmacy and Therapeutics,* copyright 2010 John Wiley and Sons (93).



A closed-loop insulin delivery system consists of three components:

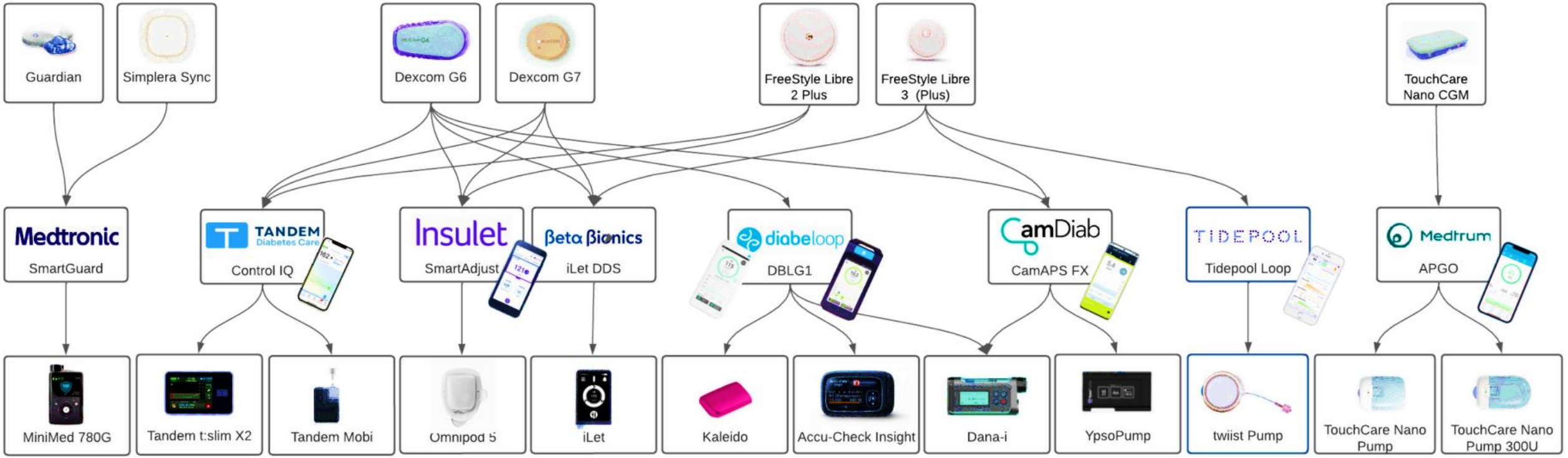
The six developmental stages of artificial pancreas device systems as originally described by JDRF



https://www.jdrf.org/blog/2011/02/09/artificial-pancreas-and-fda-the-latest/

Diabetes Care 2015;38:1036–1043 | DOI: 10.2337/dc15-0364

Available Commercial AID systems- Spring 2025



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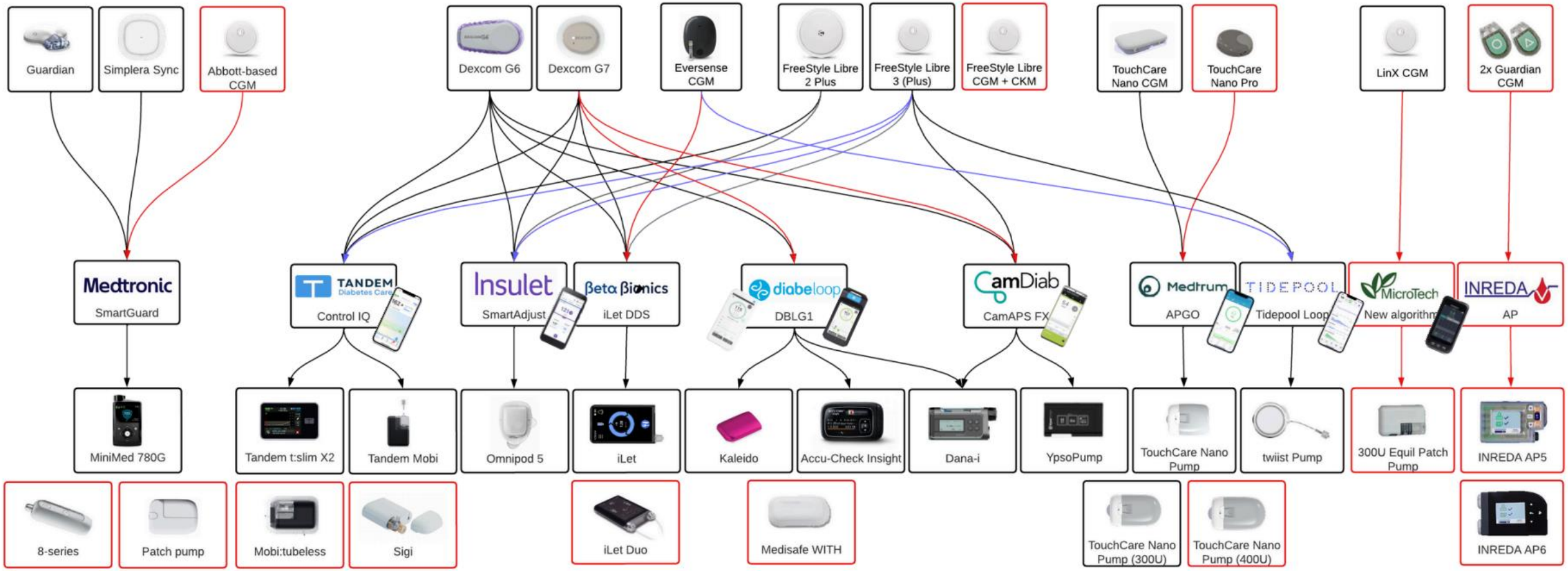
Future Commercial AID systems- Future



Diabetotech

Table 2 AID pivotal studies in children under the age of 6 years

Study detail	Omnipod 5 [34]	Medtronic 670G [35]	CamAPS FX [36]	Tandem Control-IQ [37]
Date	2022	2022	2022	2023
Study design	Single arm	Single arm	RCT, crossover	RCT
Comparator	2 week run-in	2 week run-in	CGM + pump	CGM + pump / MDI
AID duration	13 weeks	12 weeks	16 weeks	13 weeks
No. of participants	80	46	74	102
Participant age, years	2–5.9	2–6	1–7	2–5.9
Baseline HbA_{1c}, mmol/mol	57	64	56	58
Baseline HbA_{1c}, %	7.4	8	7.3	7.5
ΔTIR, %	+10.9	+8.1	+8.7	+12.4
ΔHbA_{1c}, %	−0.55	−0.5	−0.4	−0.42

Diabetologia. 2024 Oct;67(10):2075-2084. doi:10.1007/s00125-024-06218-0.

Table 1 AID pivotal studies in children and adolescents

Study detail	Medtronic 670G [21]	Tandem Control-IQ [23, 24]		Omnipod 5 [25]	Medtronic 780G [26]	iLet [27]	CamAPS FX [22, 28]	
Date	2016	2019	2020	2021	2022	2022	2018	2022
Study design	Single arm	RCT	RCT	Single arm	Single arm	RCT	RCT	RCT
Comparator	2 week run-in	CGM + pump	CGM + pump	2 week run-in	2 week run-in	Usual care (~30% on AID)	CGM + pump	CGM + pump
AID duration, months	3	6	4	3	3	3	4	6
No. of participants	124	168	101	240	157	326	86	133
Participant age, years	14–75	14–71	6–13	6–70	14–75	6 and older	6 and older	6–18
Baseline HbA_{1c}, mmol/mol (%)	57	57	58 / 61	55	58	61 / 63	67 / 66	66 67
Baseline HbA_{1c}[a], %	7.4	7.4	7.5 / 7.7	7.2	7.5	7.7 / 7.9	8.3 / 8.2	8.2 / 8.3
ΔTIR, %	+5	+11	+12.4	+9	+5.7	+11	+10.8	+6.7
ΔHbA_{1c}, %	−0.5	−0.33	−0.42	−0.38	−0.5	−0.5	−0.36	−0.32

Diabetologia. 2024 Oct;67(10):2075-2084. doi:10.1007/s00125-024-06218-0.

The need for fully closed loop:
a dream coming true!

Diabetes Care
American Diabetes Association

Limitations in Achieving Glycemic Targets From CGM Data and Persistence of Severe Hypoglycemia in Adults With Type 1 Diabetes Regardless of Insulin Delivery Method

Lori M. Laffel, Jennifer L. Sherr, Jingwen Liu, Wendy A. Wolf, Jeoffrey Bispham, Katherine S. Chapman, Daniel Finan, Lina Titievsky, Tina Liu, Kaitlin Hagan, Jason Gaglia, Keval Chandarana, Jeremy Pettus, and Richard Bergenstal

Diabetes Care 2025;48(2):273–278 | https://doi.org/10.2337/dc24-1474

OBJECTIVE

To understand glycemic control in individuals with type 1 diabetes who are using CGM, across different insulin delivery methods, including AID.

Survey Participants*

Completed study survey and provided CGM data for up to 1 year
926 Participants

Age, Years, Mean ± SD
41.9 ± 15.7

Insulin Delivery Method, n (%)[1]

MDI	Conventional insulin pumps	AID
162 (17.5)	**293 (31.6)**	**470 (50.8)**

*Participants were age 18 years and older from the T1D Exchange Registry/online community.

RESULTS

	Failed to meet TIR	Reported SHEs	HbA_{1c} <7%
CGM + MDI	50.0%	19.1%	57.3%
CGM + Pump	50.5%	16.4%	63.3%
CGM + AID	27.9%	15.5%	76.5%

AID, automated insulin delivery; CGM, continuous glucose monitoring; HbA_{1c}, hemoglobin A_{1c}; MDI, multiple daily injections; SHEs, severe hypoglycemic events; TIR, time in range.
[1]Insulin delivery method missing for 1 person

CONCLUSION

A high proportion of people with type 1 diabetes who are using CGM technology are unable to achieve clinical targets and continue to experience SHEs.

There remains an unmet need for novel therapies and technologies to improve glycemic control and reduce hypoglycemia for individuals with type 1 diabetes.

Association of Diabetic Ketoacidosis at Onset, Diabetes Technology Uptake, and Clinical Outcomes After 1 and 2 Years of Follow-up: A Collaborative Analysis of Pediatric Registries Involving 9,269 Children With Type 1 Diabetes From Nine Countries

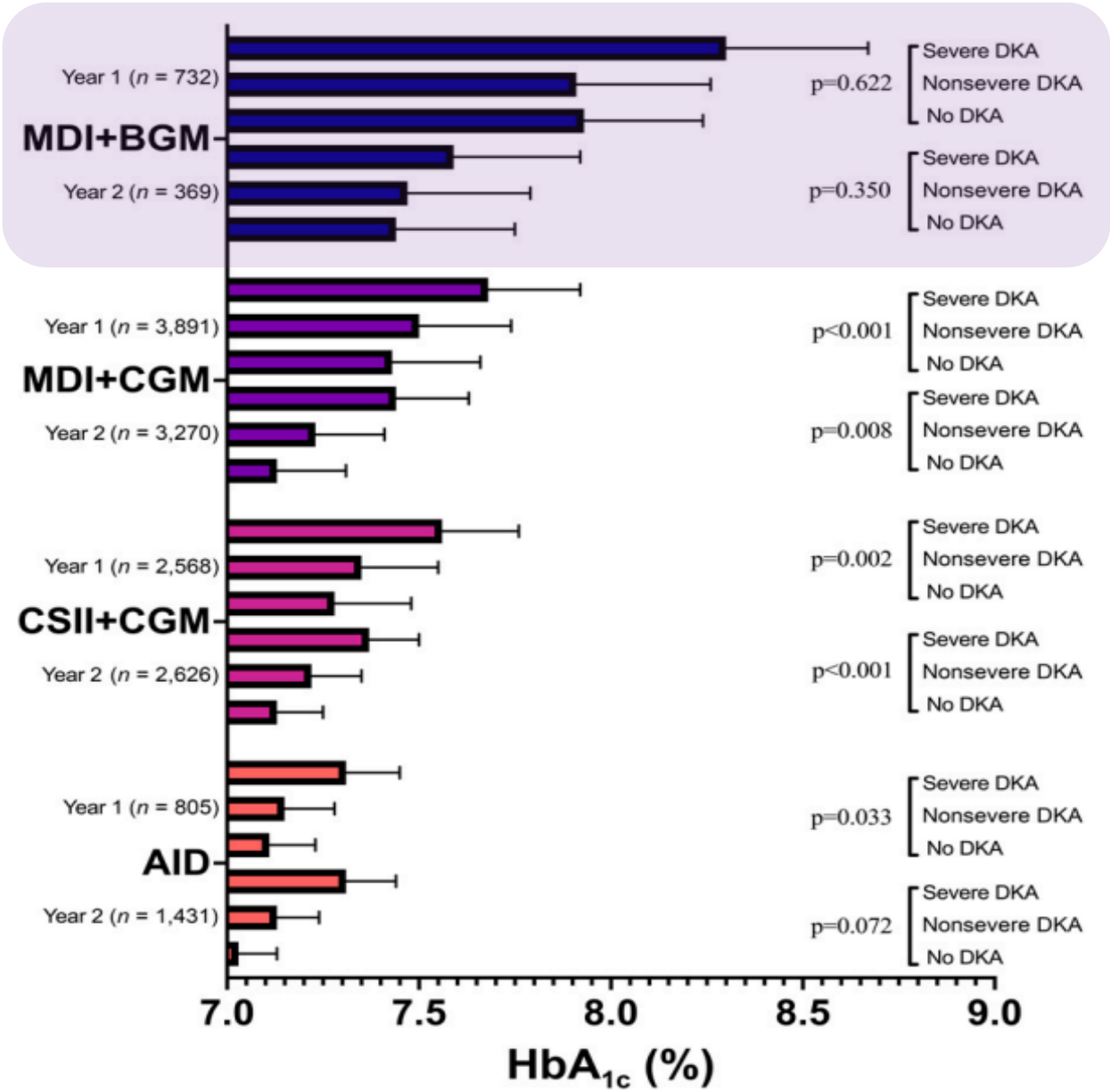
Klemen Dovc,[1] Vit Neuman,[2] Gemulla Gita,[3] Valentino Cherubini,[4] G. Todd Alonso,[5] Maria Fritsch,[6] Claudia Boettcher,[7] Carine de Beaufort,[8,9] Reinhard W. Holl,[10] and Martin de Bock[11]

[1]Department of Endocrinology, Diabetes and Metabolism, University Children's Hospital, University Medical Centre Ljubljana, and Faculty of Medicine, University of Ljubljana, Ljubljana,

Diabetes Care 2025;48:648–654 | https://doi.org/10.2337/dc24-2483

- International study including 9 population-based registries:

  Austria, Czechia, Germany, Italy, Luxembourg, New Zealand, Slovenia, Switzerland and USA (Colorado)



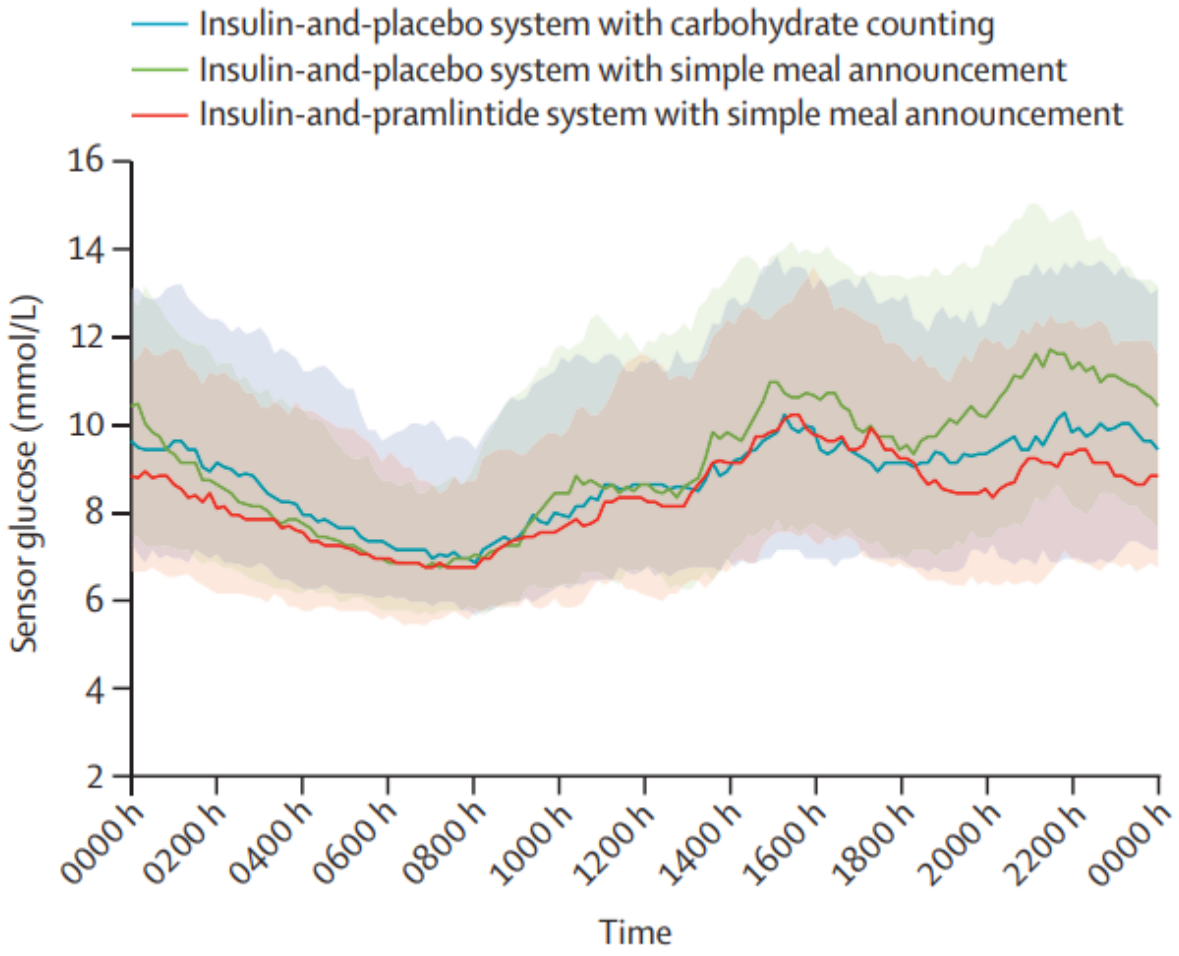
Diabetes Care 2025;48(4):648–654 | https://doi.org/10.2337/dc24-2483

Simple meal announcements and pramlintide delivery versus carbohydrate counting in type 1 diabetes with automated fast-acting insulin aspart delivery: a randomised crossover trial in Montreal, Canada

Elisa Cohen, Michael A Tsoukas*, Laurent Legault, Michael Vallis, Julia E Von Oettingen, Emilie Palisaitis, Madison Odabassian, Jean-François Yale, Natasha Garfield, Nikita Gouchie-Provencher, Joanna Rutkowski, Adnan Jafar, Milad Ghanbari, Ahmad Haidar*

Non-inferiority of the insulin-and-pramlintide system with simple meal announcements relative to the insulin-and-placebo system with carbohydrate counting was reached (difference –5% [95% CI –9·0 to –0·7], non-inferiority p<0·0001).

- **Safe alleviation of carbohydrate counting without degradation of glucose control is the ultimate goal of next-generation closed-loop systems**



Cohen, Elisa et al. The Lancet Digital Health, Volume 6, Issue 7, e489 - e499

The place of “SMBG”?

Connected BGM

The Iranian Effort

FREESENS SMART View

Insights beyond the numerical glucose results

SMBG Data Quality
Provides insights on SMBG Adherence

Point in Range
Provides insights on glycemic variability

Modal View
Provides insights intra-day variability

Hypo Risk Analysis
Provides insights on hypoglycemic events

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Abstract Number: 995

Abstract Title:

Insightfully Scanned Glucose Monitoring (iSGM) In Clinical Decision Making And Patient-physician Communication: A Novel Modality For Resource-limited Settings

Background and Aims

CGM is becoming standard of care in diabetes, however not easily accessible in low- and middle-income countries (LMICs). Capillary blood glucose monitoring is the most accessible tool. Patient-reported Blood Glucose (BG) data are known to be inaccurate. Physician's access to aggregated BG data is limited with complexity of Bluetooth and cable-connected devices. Insightfully scanned glucose monitoring (iSGM), a novel integration of NFC [illegible] glucose meter with a mobile application can provide physicians with glucose analysis including [illegible] (PIR), modal view and hypoglycemia report. This study evaluates the benefits of iSGM in therap[illegible]ic decision making and patient-physician communication.

Methods

Individuals with T1DM and T2DM were consecutively recruited from seventeen practices. Patient [illegible]orte[illegible] were compared to iSGM reports. Physician's perspective was evaluated using a questionnaire.

Results

161 Individuals, 53% female, 52% T2DM, median age 38 years (IQR 15-59), median diabetes durati[illegible] 4-15) and median HbA1c 8% (IQR 7.05-9.50) completed the study. 9282 glucose values were downl[illegible]. 31.7% were missing in patient-reported data. 29.6% of patient-reported values were fabricated. 39% of hypoglycemia events were missing. 55.4% of patient-reported data was clinically reliable. 100% of physicians agreed iSGM provides a comprehensive analysis on glycemic control, while only 17% agreed BG logging was helpful for therapeutic adjustments. 94% of physicians agreed iSGM is an effective tool for hypoglycemia identification, facilitates patient-physician communication and patient-centered diabetes care.

Conclusions

iSGM compared to BG logging is an effective modality for insightful and accurate therapeutic adjustments and may facilitates diabetes care especially in LMICs.

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Barriers in Using Technology in Diabetes

Barriers

- Cost
- Availability
  - Sanction
- Lack of knowledge
  - Public
  - HCPs
- Sophisticated regulations
- Cybersecurity
- Too many alarms
- Concerns about accuracy
- Interference with sports/activities

The PWD experience in a digital environment is influenced by social and digital determinants of health

Social determinants of health

- **Economic** stability
- **Health care** access and quality
- **Education** access and quality
- **Social** and community context
- Neighborhood and built **environment**

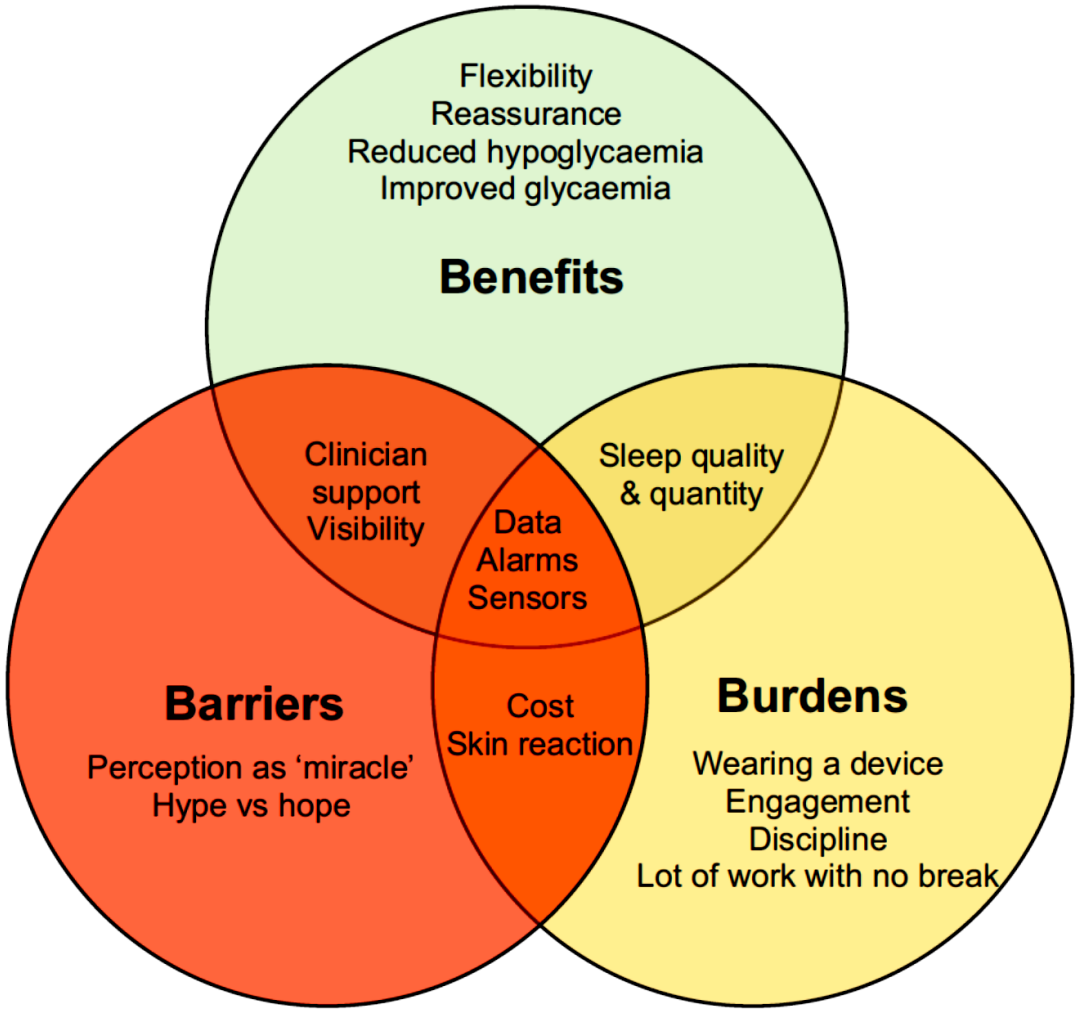
Digital determinants of health

- **Access** to technological tools
- **Quality and nature** of digital content
- Digital **literacy**
- Community **infrastructure**

Social and digital determinants of health can function as **barriers or facilitators** of health, interacting with one another to impact outcomes

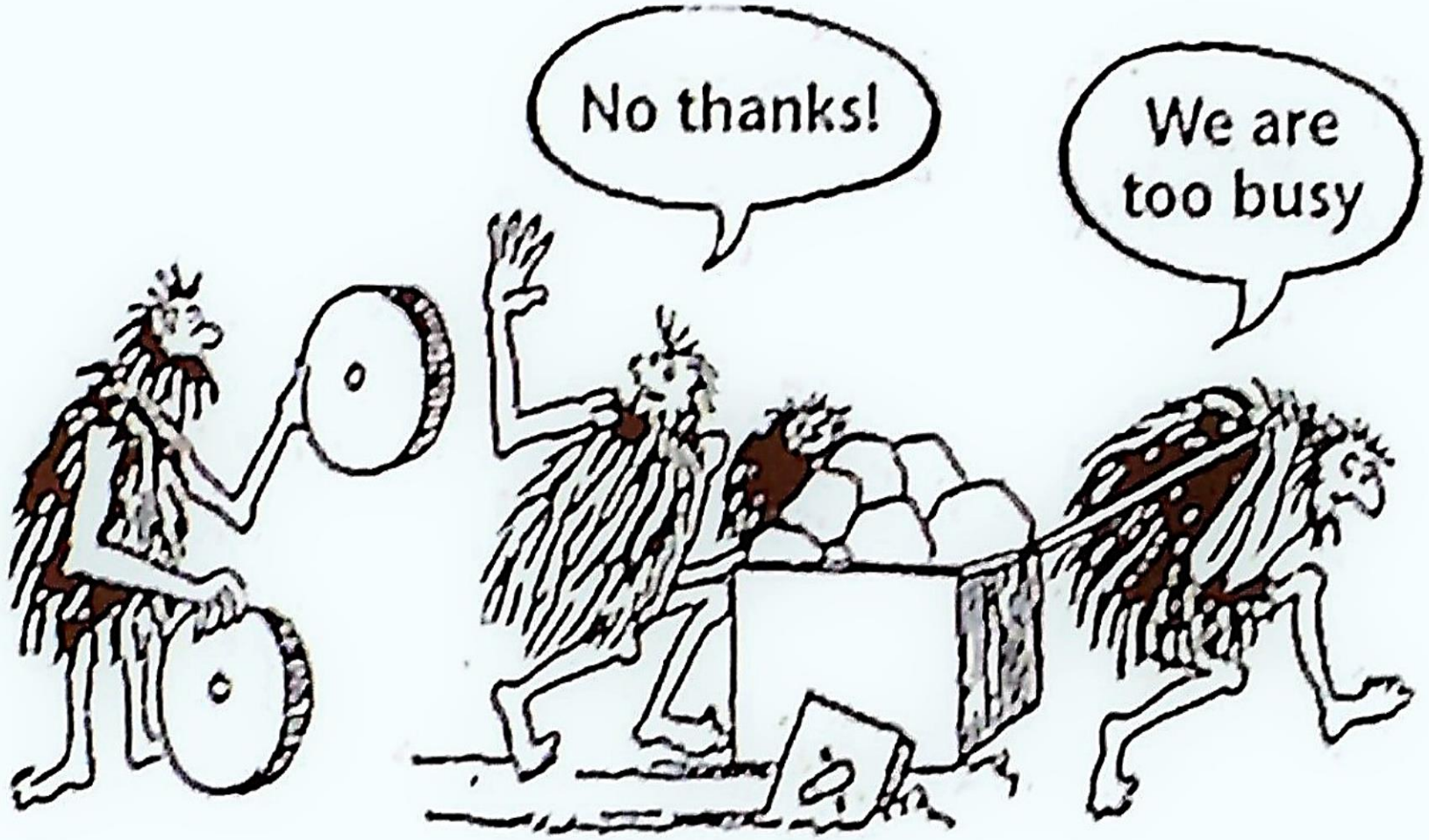
Richardson S, et al. NPJ Digit Med 2022;5:119.

The 3Bs associated with using diabetes technologies from the perspective of the PWD-T_1

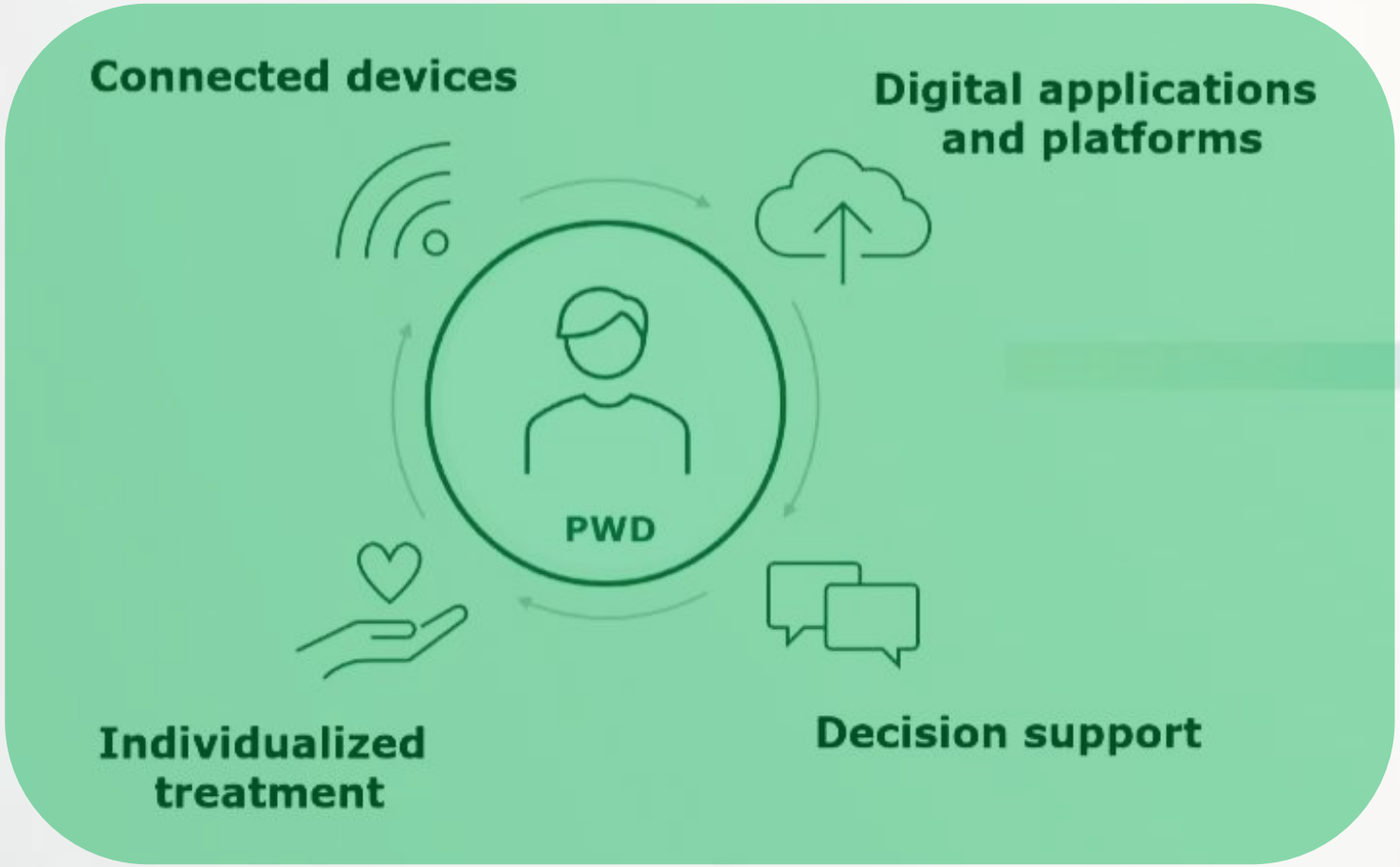


Speight J, et al. *Diabet Med*. 2023;40:e14944. doi: 10.1111/dme.14944

Any innovation has its' pace of acceptance!



The future of digital solutions in diabetes should aim to further tackle such challenges to reach its full potential



Electronic health records

In an effective digital ecosystem, **passive data integration** is essential to improve access and reduce the burden on both PWD and HCPs

An illustration to demonstrate a proposed connected ecosystem. Kerr et al. Endocr Pract 2023;29:179–84.

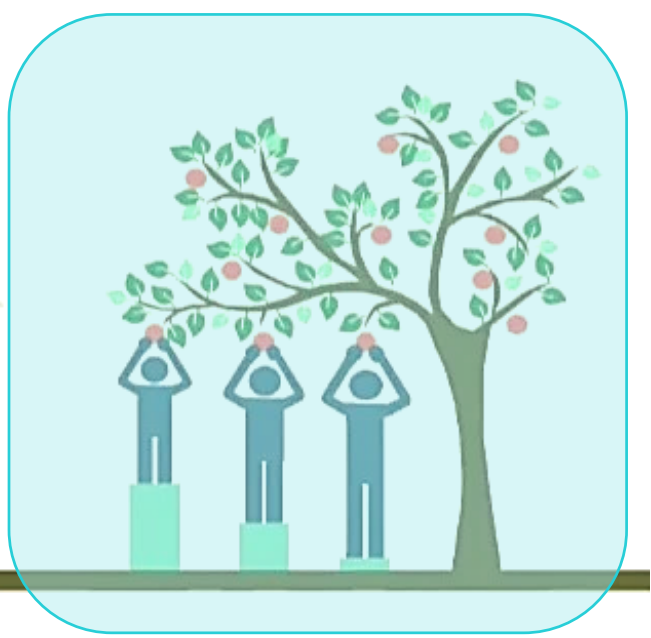
If designed and implemented appropriately, digital solutions can help to reduce health inequity in diabetes

For digital solutions to cater for all and reduce inequity in care, they need to be adapted to meet the different needs of different populations

Personalized support based on wider determinants of health[1,2]

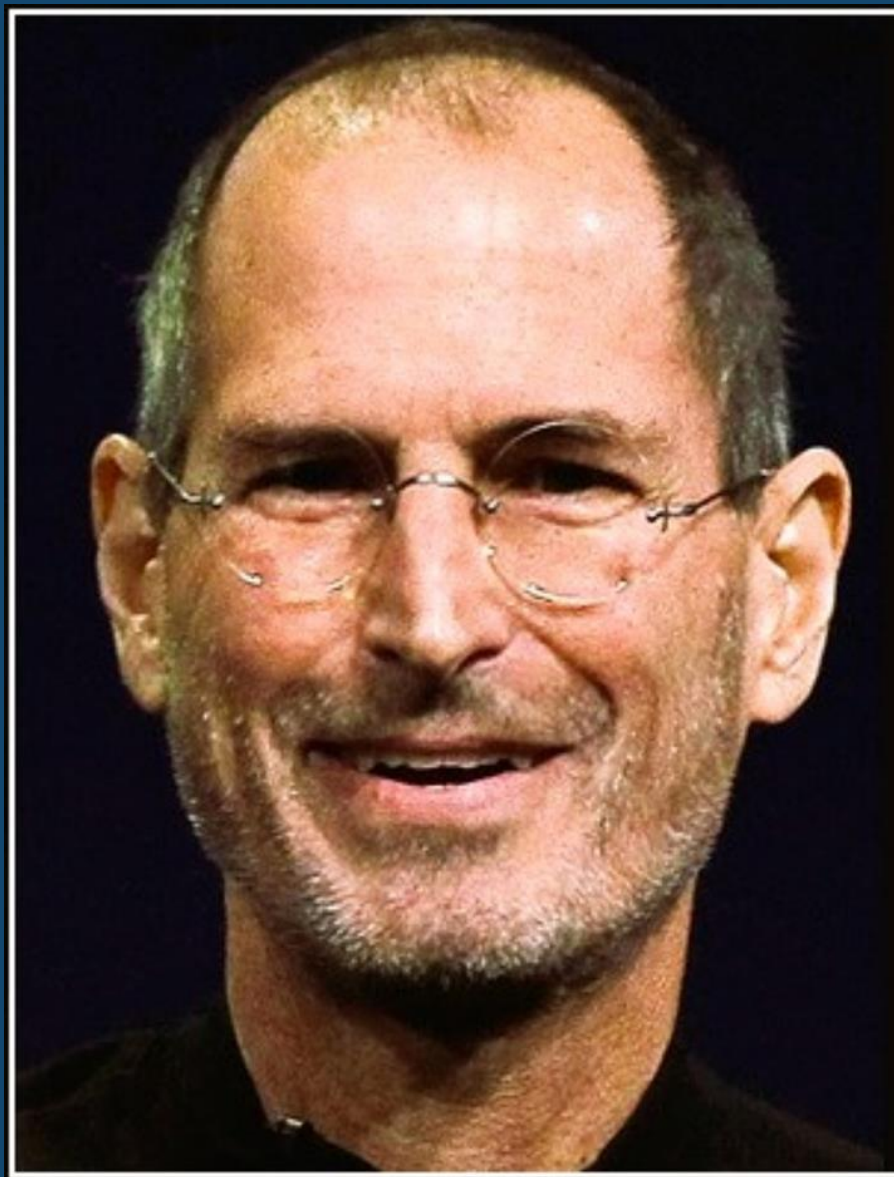
Overcoming the digital divide[2–4]

Supporting equitable access to healthcare[2–4]



However, the use of digital solutions in diabetes is currently limited by several challenges*[5,6]

*Challenges regarding the use of digital solutions in diabetes may include: integration into the EMR, availability of digital infrastructure, inadequate HCP training, digital literacy, data privacy, and evidence on safety and effectiveness.[5,6] EMR, electronic medical record. 1. Ranscombe R. Lancet Diabetes Endocrinol 2015;3:506; 2. Forde H, et al. Diabetes Med 2022;e14977; 3. Mayberry LS, et al. Curr Diab Rep 2019;9:148; 4. Graetz I, et al. Am J Manag Care 2018;24:43–8; 5. Fleming GA, et al. Diabetes Care 2020;43:250–60; 6. Sheon AR, et al. JMIR Diabetes 2017;2:e16.



It's not a faith in technology. It's faith in people.

— Steve Jobs —

Thank you

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دیابت