Technological Advances and the Evolution of CGM-Based Diabetes Management

Focus on Pivotal Advantages of **Personalized A1c**, **Noninsulin Therapies** and **Ketone Monitoring**

EASD 2025 VIENNA

Leveraging CGM to Drive Behavioral and Lifestyle Interventions

1

This CME-certified simulcast symposium is jointly provided by the UMASS Chan Medical School and CMEducation Resources.

Commercial Support: Supported by an educational grant from Abbott Diabetes Care

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Program Faculty

Univ. Prof. Thomas Wascher— Program Chair
Head Diabetology, Endocrinology, Metabolic Diseases
Hanusch Hospital
Vienna, Austria

Richard Bergenstal, MD
Executive Director
International Diabetes Center- Park Nicollet
Minneapolis, MN

Prof. Ramzi Ajjan, MD, PhD
Professor of Metabolic Medicine
Consultant in Diabetes and Endocrinology
University of Leeds and Leeds Teaching Hospitals Trust
Leeds, United Kingdom

Prof. Monika Kellerer, MD
Professor of Internal Medicine
Director, Department of Diabetology and Endocrinology, Angiology, Intensive Care Unit and Cardiology
Marienhospital Stuttgart, Germany

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Pre-Program Assessment Question #1

Based on my current practice pattern, I **initiate CGM monitoring** in approximately the following percentage of new persons with T2D who present to me and who are NOT taking insulin (i.e. persons managing diabetes with lifestyle modification or oral medications only)

1) 20–30%
2) 30-40%
3) 40–50%
4) 50–60%
5) >60%

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Pre-Program Assessment Question #2

CGM is a foundational management strategy in all of the following settings: (1) Overcoming treatment inertia, (2) Modulating patient lifestyle behaviors and decisions, and (3) Adjusting pharmacologic interventions to optimize HbA1c.

1) Strongly agree
2) Agree
3) Agree in some situations
4) Disagree
5) Strongly disagree

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Profound Impact of Dual Glucose Ketone Monitoring

Richard Bergenstal, MD
Executive Director Park Nicollet International Diabetes Center Adjunct Professor, Department of Medicine University of Minnesota St. Louis Park, MN

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Potential Profound Impact of Dual Glucose Ketone Monitoring

Richard Bergenstal, MD
Executive Director Park Nicollet International Diabetes Center Adjunct Professor, Department of Medicine University of Minnesota St. Louis Park, MN

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Disclosures: Richard M. Bergenstal, MD

- **I have no personal financial disclosures**
- My employer, the non-profit HealthPartners Institute, contracts for my services, and I receive no personal income from the following activities:
  - I have participated in clinical research, been a member of a scientific advisory board, and served as a consultant for:
    - Abbott Diabetes Care, Ascensia, Bigfoot Biomedical, Inc., CeQur, Dexcom, Eli Lilly, Embecta, Hygieia, Insulet, Mannkind, Medtronic, Medscape, NCQA, Novo Nordisk, Onduo, Roche Diabetes Care, Sanofi, Tandem, United Healthcare, Vertex Pharmaceuticals and Zealand Pharma
    - HealthPartners Institute holds a patent for display screen with graphical user interface
    - HealthPartners Institute receives NIH/NIDDK and PCORI funding

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What Will It Take to Get There?

2018

THE LANCET Published online February 16, 2018

Continuous glucose monitoring: transforming diabetes management step by step

Richard M Bergenstal
International Diabetes Center at Park Nicollet

What will it take to get here?

2028

Dual Glucose Ketone continuous monitoring: transforming DKA-Prevention step by step

International Diabetes Center

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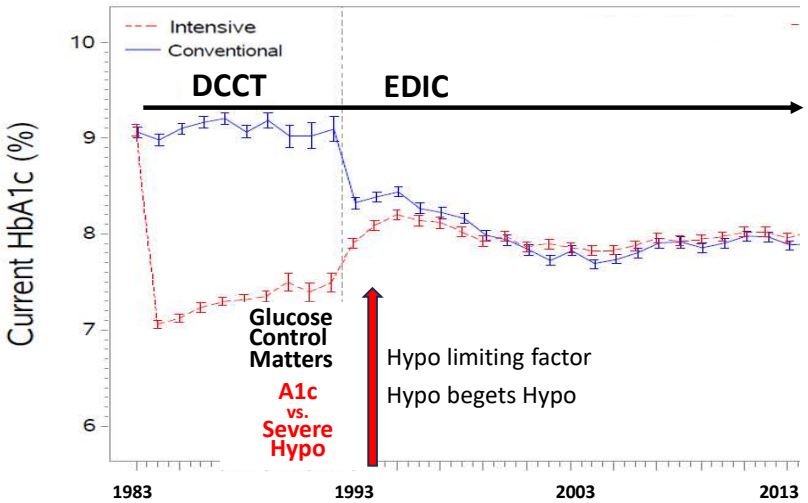
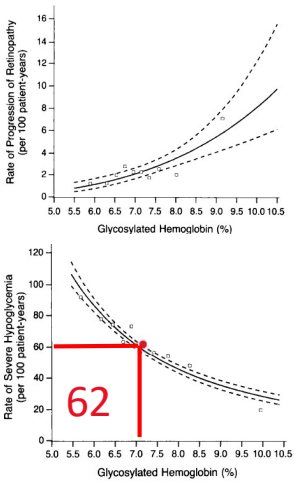
DCCT / EDIC at 40 Years





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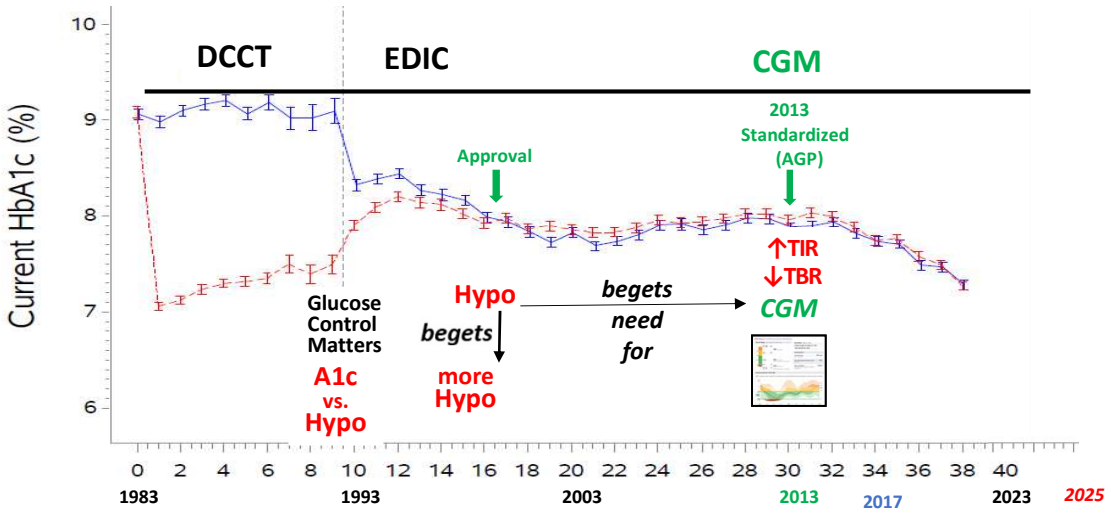
DCCT / EDIC at 40 Years:
Need for Continual Transformations in Management



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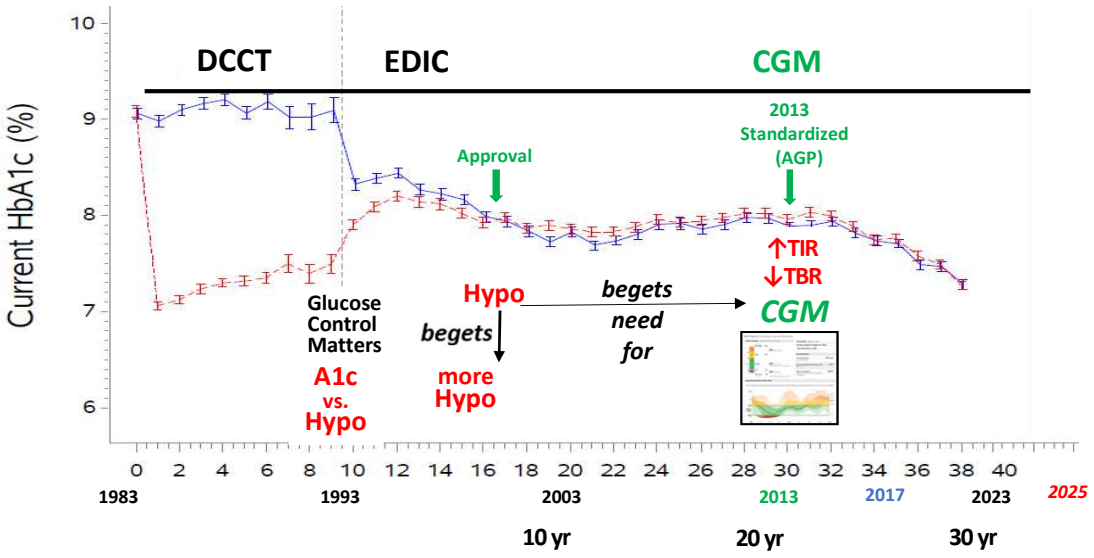
DCCT / EDIC After 20 Years: (1) CGM is Now Addressing Hypoglycemia (2) Glycemic Management Dialogue and SOC Start to Change



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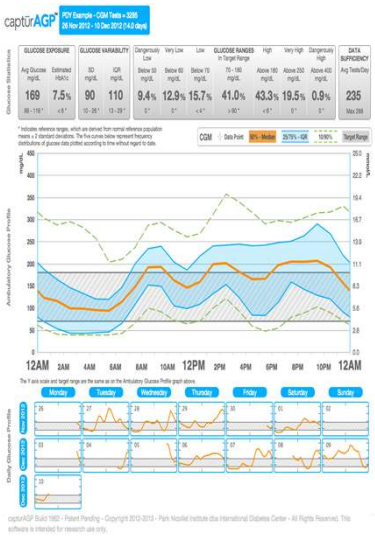
CGM Report Evolution

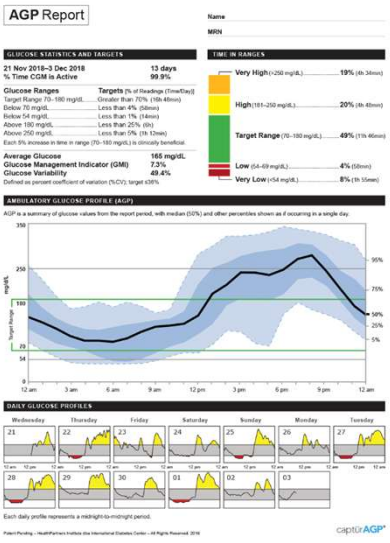
Core Metrics

Targets for Core Metrics

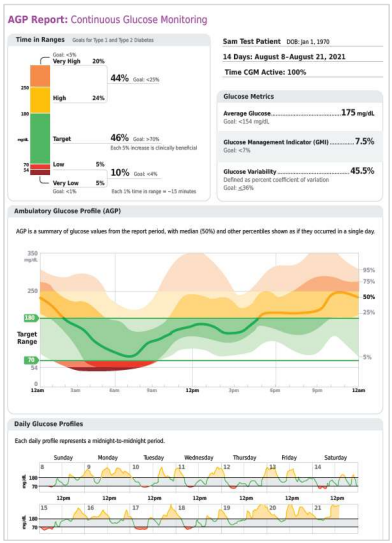
2013



2019



2021



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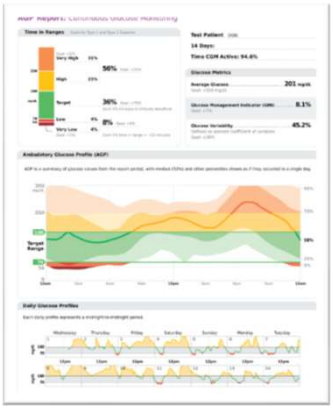
Using CGM to Improve Glycemic Management is a 2-Part Process and BOTH are Important

Patient analysis
Real-time

Phone

Clinician analysis
Retrospective

Cloud or EHR



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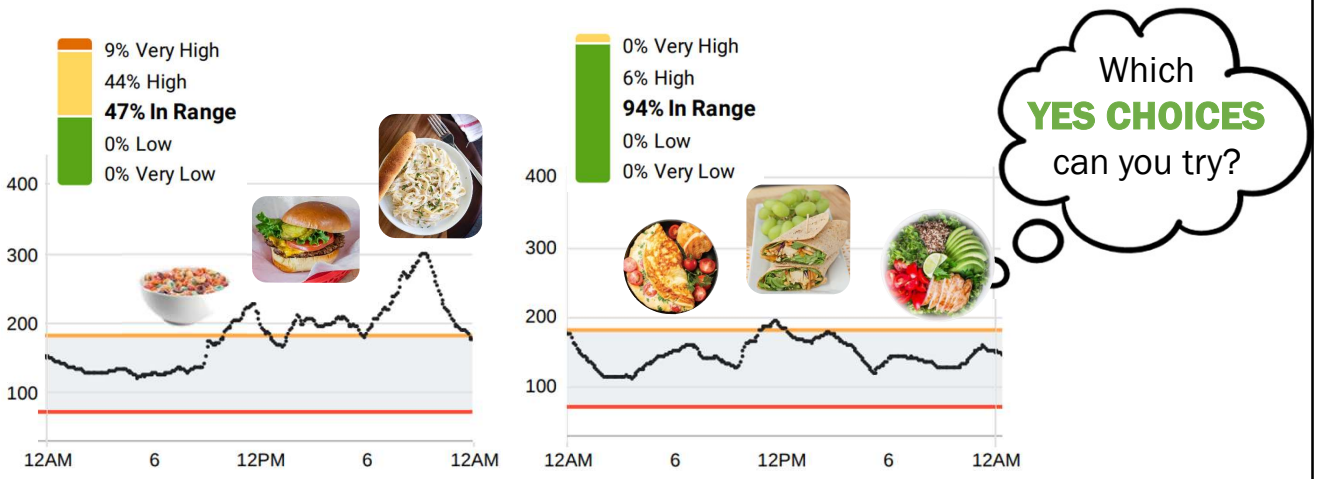
BE CURIOUS, try it and see!

Everyone's glucose response is unique.



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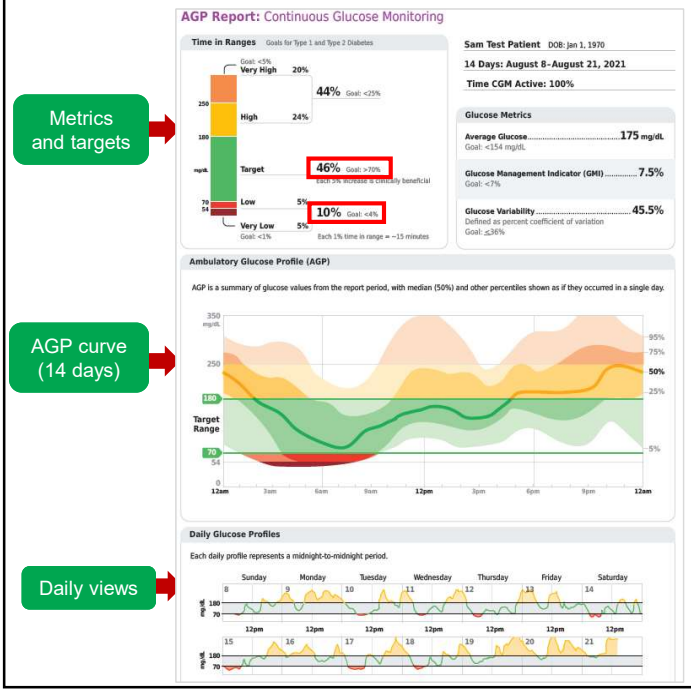
Ambulatory Glucose Profile (AGP): 3 Steps to an Action Plan



Determine Where to Act

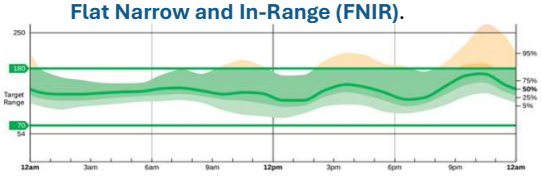
1. **Determine** if action is needed.
   - Review time in range and time below range.
   - Action is needed if:

     Time in Range (70-180mg/dL) is not >70-80% **or**

     Time Below Range (<70 mg/dL) is not <4%

     Goal: More Green, Less Red

2. **Where** is action needed?
   - Review the AGP curve and daily views.
   - Action is needed where the AGP curve is not yet **Flat Narrow and In-Range (FNIR)**.



   - Treat any hypoglycemia (red) first.
3. **Act** on the data.
   - Adjust lifestyle & medications to achieve **MGLR** and **FNIR**.
   - Adjust, adjust, adjust!

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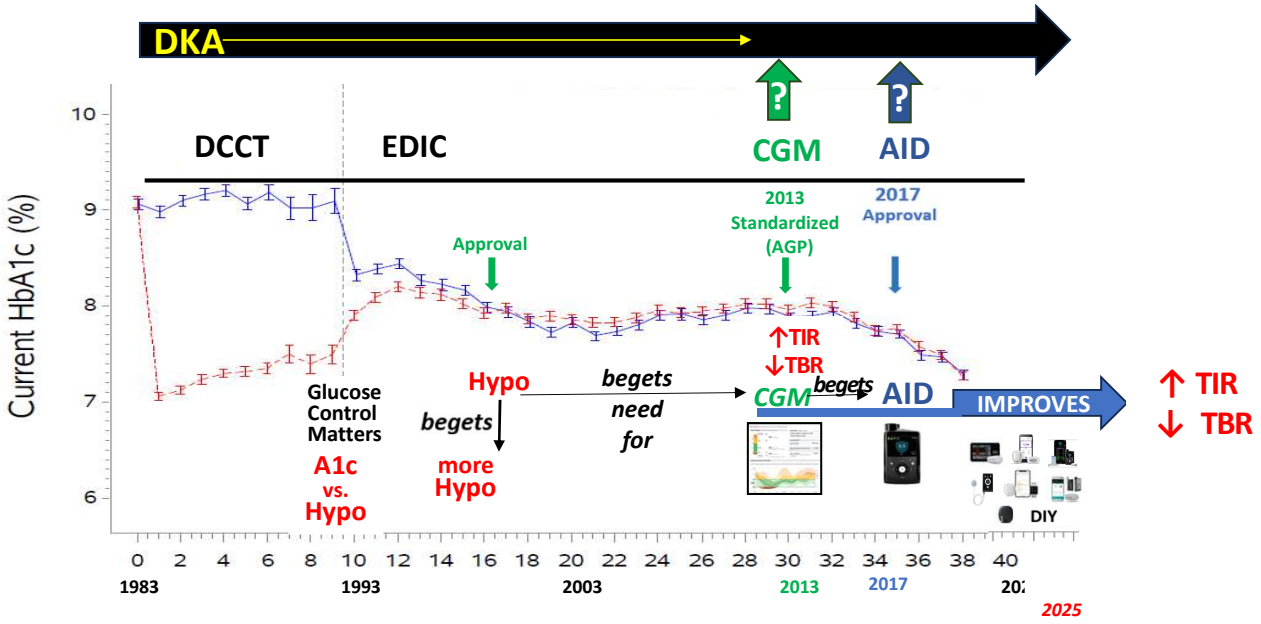
DCCT
EDIC after 30 years: AID addressing TIR and TBR

Time for more focus on preventing DKA?



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DKA a Major Health Risk for T1D and T2D[1,2]

Most common **hyperglycemic emergency** in persons living with diabetes[2]

DKA is a **leading cause of death** among children and adults (< 58) with diabetes[2]

1%–13% annual prevalence of DKA in adults with T1D across countries[2]

DKA and T2D

Hospitalization for DKA: 1 in 5 cases attributed to T2D[3]

Higher mortality for T2D (0.85%) with DKA than T1D (0.2%)[4]

DKA=diabetic ketoacidosis; ED=emergency department; T1D=type 1 diabetes; T2D=type 2 diabetes.

References: 1. Umpierrez, G.E., *Diabetes Care* (2024). https://doi.org/10.2337/dci24-0032. 2. Nguyen, K.T., *Journal of Diabetes Science and Technology* (2022). 3. Zhong et al, *Diabetes Care* (2018): https://doi.org/10.2337/dc17-1583. 4. Canales, SP, *Endocrine Practice* (2024): https://doi.org/10.1016/j.eprac.2024.03.163. https://doi.org/10.1177/19322968211042656.

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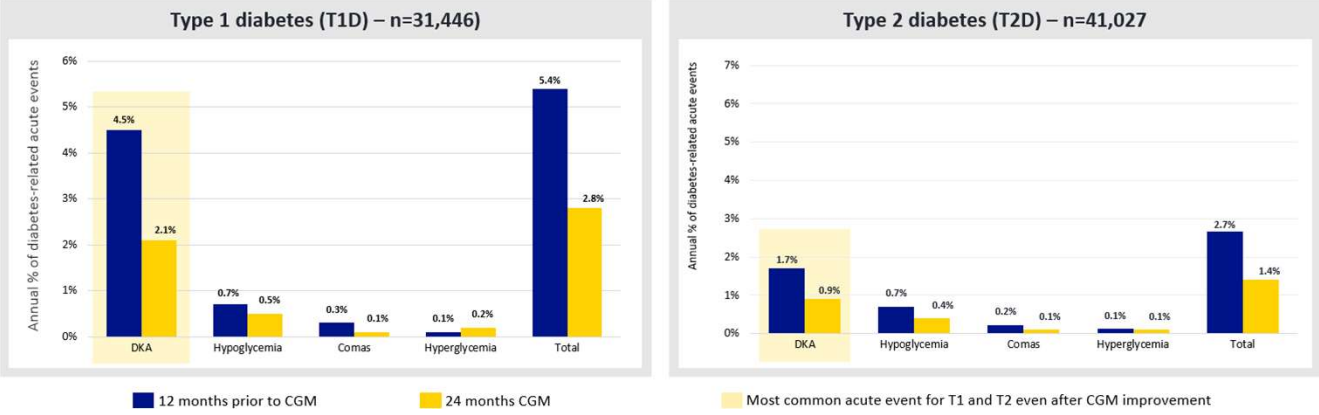
CGM Use Reduces DKA by 50% But It is Still the Most Common Acute Event

RELIEF Study

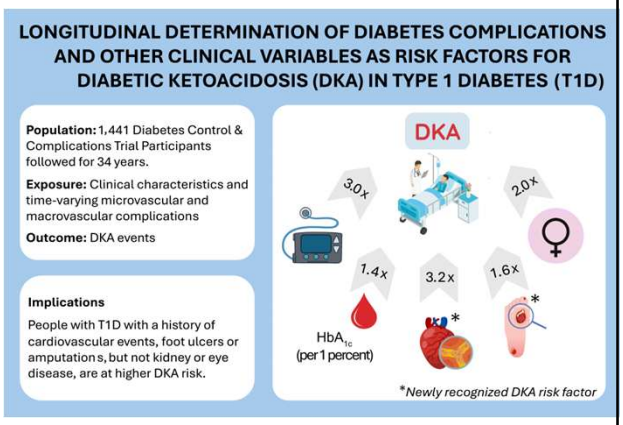


Riveline et al, *Diabetes Technol Ther.* (2022): doi.org/10.1089/dia.2022.0085

Who Is at Highest Risk for DKA?

Risk for DKA

1. **T1D** / T2D
2. **History of DKA**
3. **Diabetes + Acute illness**
4. **Use of insulin pump (infusion set block/dislodge)**
5. **Freq very high glucoses**
   a. **Insulin omission**
   b. **Disordered eating**
   c. **Lack of access to care/SES**
6. **Diabetes and Ketogenic Diet**
7. **Women**
8. **Pregnancy**
9. **Use of SGLT2i & Diabetes** (Euglycemic DKA)
10. **Hx CVD events**
11. **Foot ulcers/ amputations**

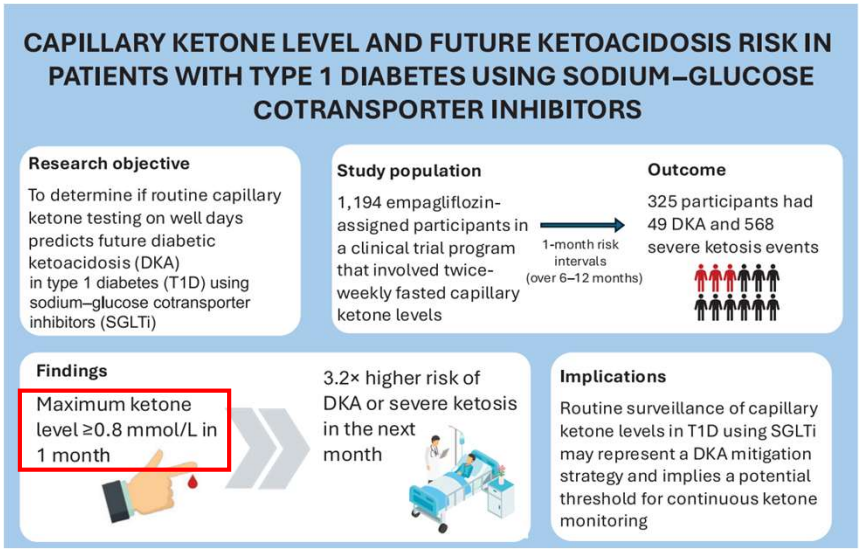


Diabetes Care, April 2025

CKD
CKD did not increase DKA risk

Diabetes Care. 2025;48(4):614-622. doi:10.2337/dc24-2385

What Are the Implications of the Findings?



Findings imply an additional role for ketone measurement in clinical practice and trials evaluating for **SGLTi in T1D** and **support future implementation of continuous ketone monitoring**.

Priya Bapat, Bruce A. Perkins et al
Diabetes Care 2025;48(6):1016–1021

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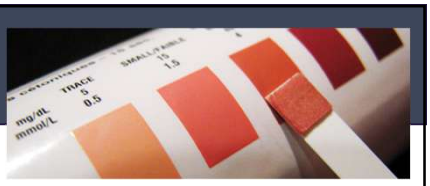
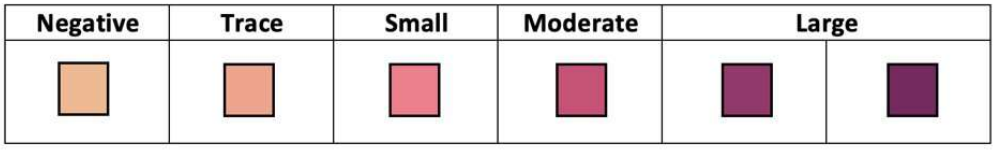
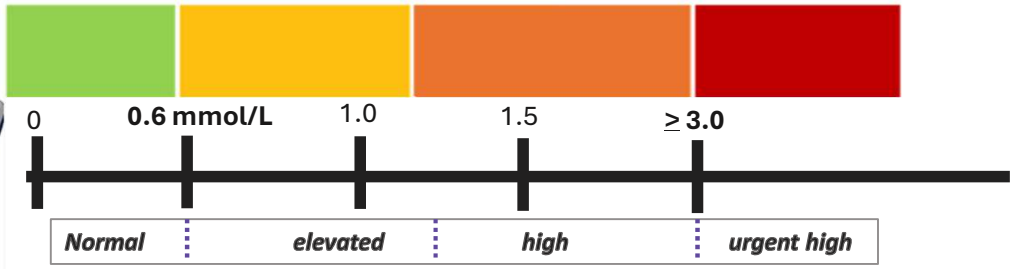
Quantifying Ketones



Acetoacetate Measured via Urine is a Colometric Test





β-hydroxybutyrate via Capillary Check is Quantitative

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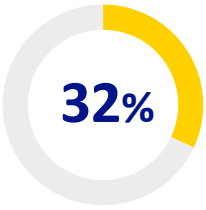
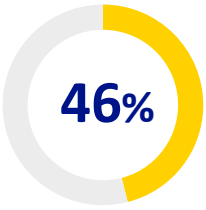
Many people with diabetes are not aware of DKA and may not be prepared for a DKA emergency

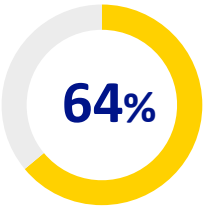
Multinational, Multicenter Survey of Endocrine Outpatient Clinic Patients With Average Duration of T1D of 22 Years (N=333)



Were not familiar with the term DKA*



Were unable to name a single symptom of DKA



Did not test for ketones at all

DKA=diabetic ketoacidosis; T1D=type 1 diabetes.
*Participants rated their own knowledge of DKA significantly lower than their physicians did (p<0.0001).
Reference: Hepprich, M., ***BMJ Open Diabetes Research & Care*** **(2023). https://doi.org/10.1136/bmjdrc-2023-003662.**

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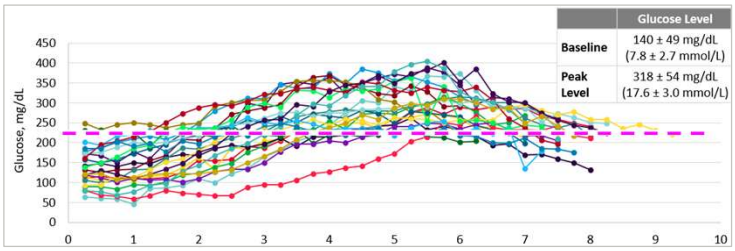
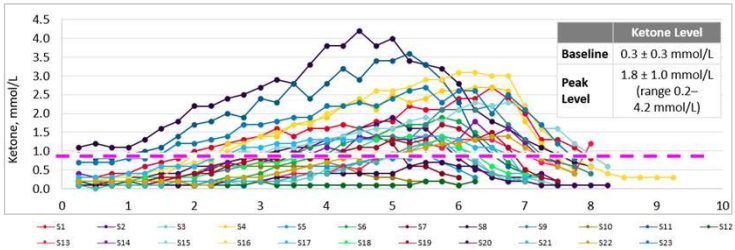
Variability in Ketone Generated, Not Dependent on Starting Glucose or Duration of Diabetes

New solutions in development

Glucose Profiles During Pump Suspension



Ketone Profiles During Pump Suspension



Data on file. Abbott Diabetes Care.

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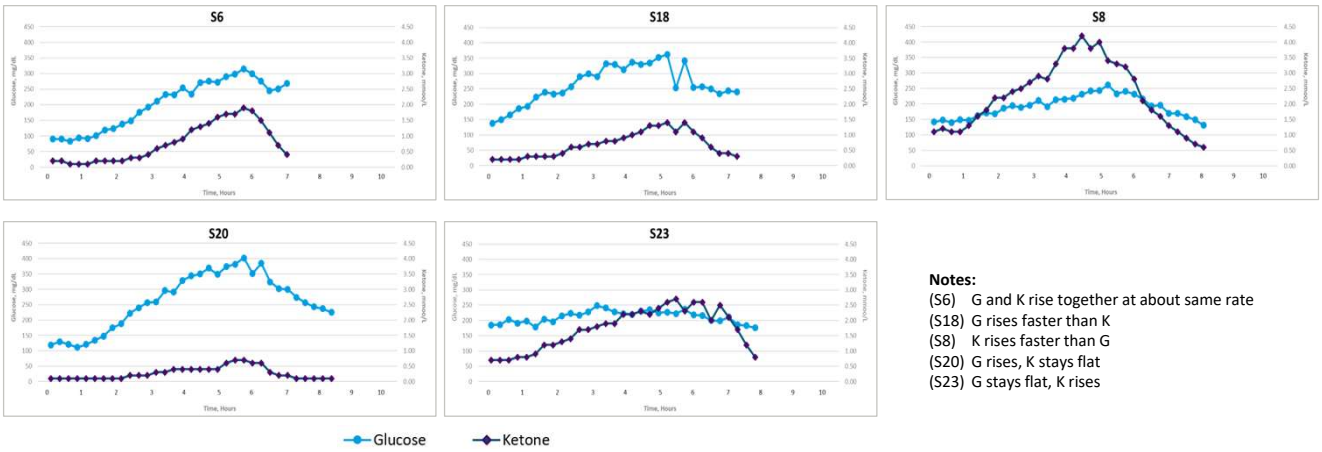
Ketone Profile – Pump Interruption Feasibility Study

Innovating DKA Management with
Continuous Ketone Monitoring and Early Warnings



Notes:
(S6) G and K rise together at about same rate
(S18) G rises faster than K
(S8) K rises faster than G
(S20) G rises, K stays flat
(S23) G stays flat, K rises

Data on file. Abbott Diabetes Care.

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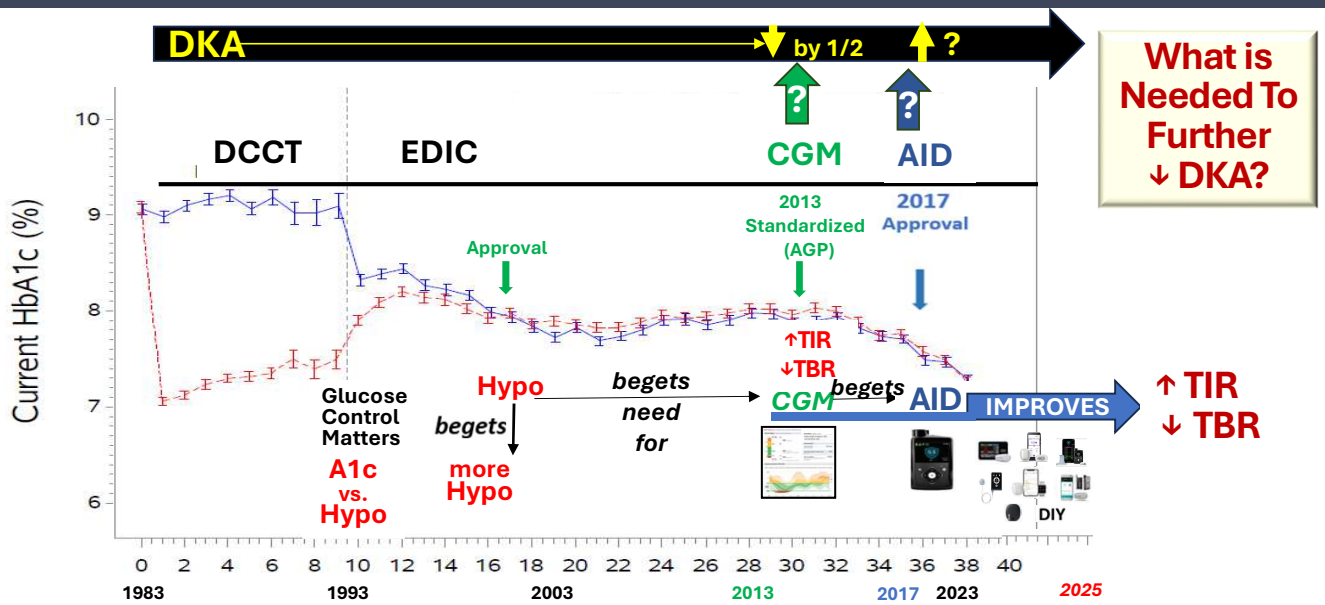
DCCT

EDIC After 30 Years: Next Steps for Glucose and Ketone Monitoring and Management?



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Ensure the Ketone Measurement System is:

Easy

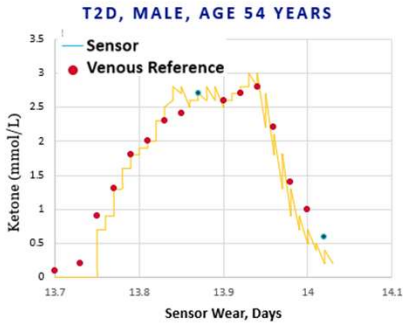
Dual glucose ketone system under development.

Imagery for illustration purposes only.

1. Nguyen KT et al, J Diabetes Sci Technol (2022): https://doi.org/10.1177/19322968211042656.

Accurate

Ketone Response – Exogenous Ketone Ingestion



Unpublished results - Data on file. Abbott Diabetes Care Inc.

The product is under development and not available for sale

Actionable

iCGM and iCKM?

Highest standards of accuracy needed for interoperability or integrations

Plans for Integration of CKM into AID systems are growing

1) Sequel
2) Tandem
3) Beta Bionics
4) Ypsomed & CamDiab
5) …

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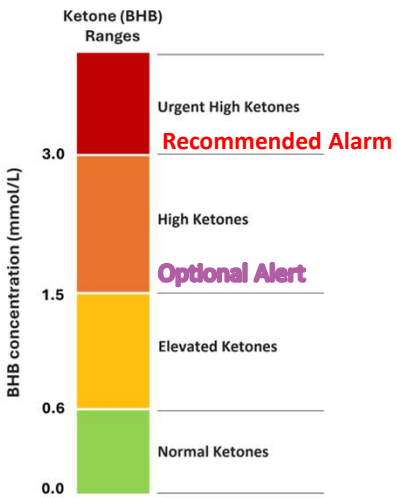
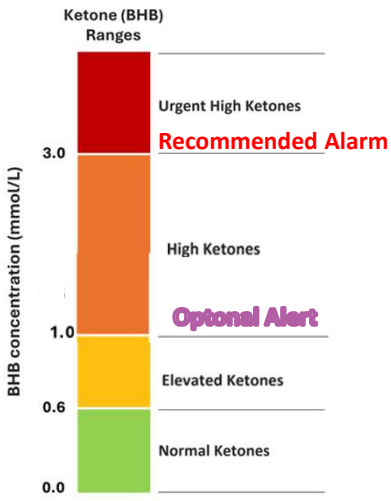
To Take Action to Prevent DKA – We Need Standardized Definitions of Elevated and High Risk Ketone (*βHB*) Levels





Breakthrough T1D

International Expert Consensus Report

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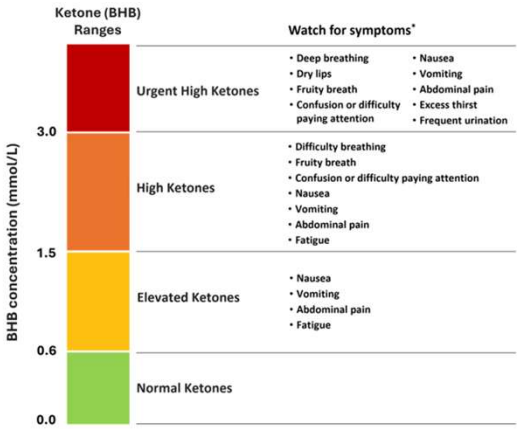
Agree on Action Plan to Reduce the Measured Risk Factors

• PwD



Actions to be taken

Wallet Card

• HCP's

STOP DKA protocol[2]

Modified to include CKM along with CGM

- **S** **Symptoms**
- **T** **Test** ketones & glucose
- **O** **Oral** ingestion of fluid and carbohydrates
- **P** **Protocol** instructions for supplemental insulin & CHOs

Goldenberg RM, et al.
Diabetes Obes Metab. 2019; 21:2192-2202

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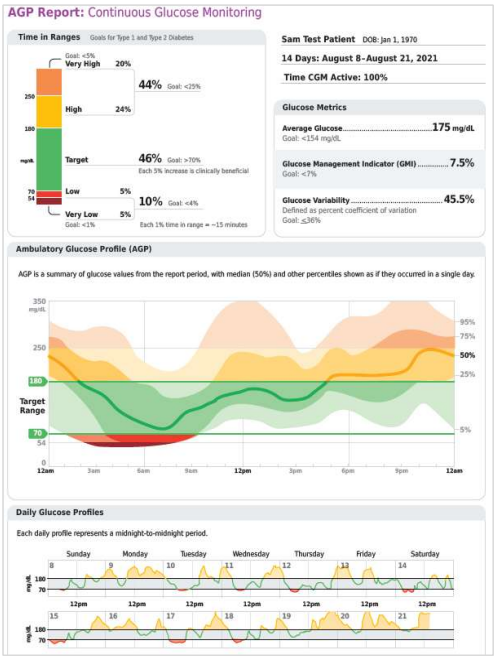
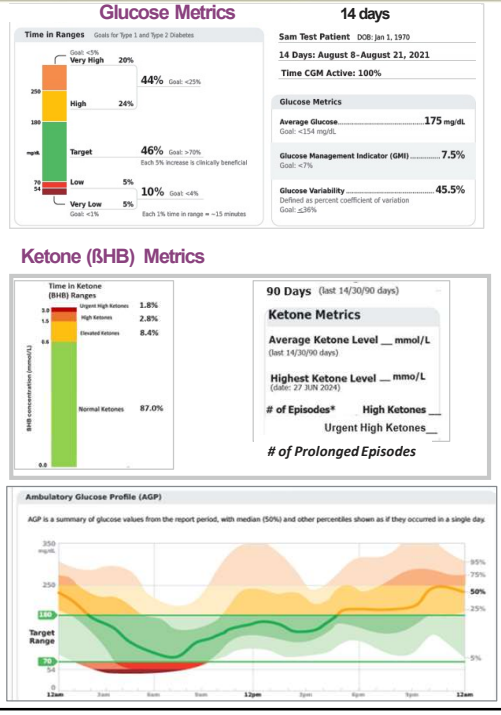
AGP for CGM



AGP for Dual Glucose Ketone (DGK) Sensor



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Preventing Diabetic Ketoacidosis with Continuous Ketone Monitorin: Insights from a Clinical Research Case

55-year-old male with a 53-year history of type 1 diabetes

- Undetectable C-peptide
- **AID system** with a tubed insulin pump
- Total daily insulin dose was 0.5 units/kg/day
- CGM TIR 83%, TAR 14%
- HbA1c was 6.9% (51.9 mmol/mol)
- Last episode of DKA was during childhood

- In Clinical trial on **Dapagliflozin** 10 mg/d or Placebo
- **Using CKM system in development** - alarms at 1.0
  BHB 0.6 -1.0 – review data q2-4 hr
  1.0-1.5 - suggest change pump sites, hydrate, insulin pen/pump
  over 1.5 – mandate site change and insulin via pen

Yee Wen Kong, David N. O'Neal, et al,
University of Melbourne, Victoria, Australia
International Diabetes Center
DIABETES TECHNOLOGY & THERAPEUTICS, Online Aug 205

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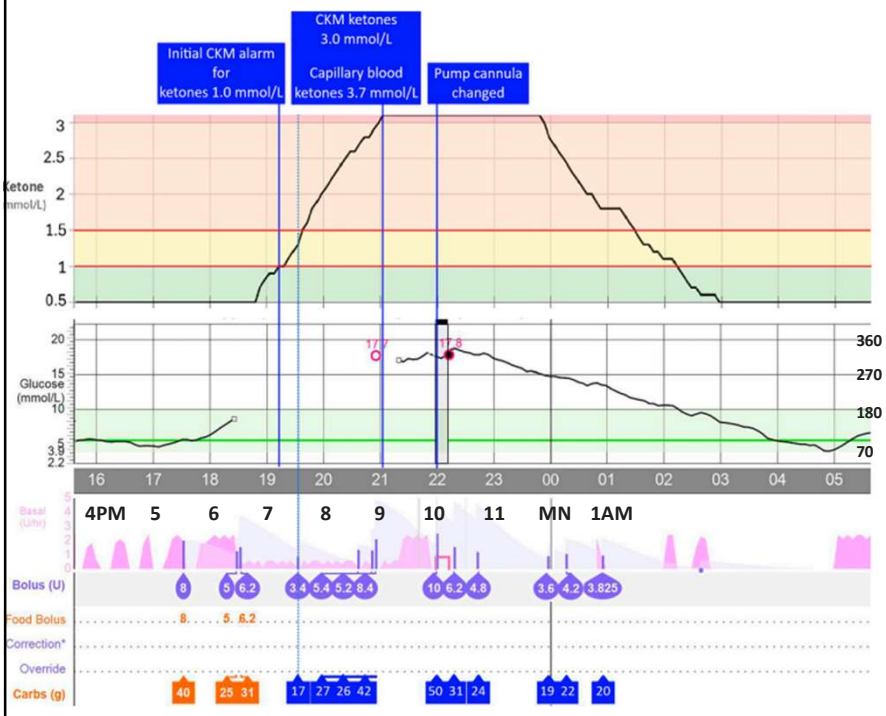

- Worked in the garden in the afternoon
- Premeal pump boluses 5:30 and 6:30 PM ---- glucose started up post-meal

6:30 PM CGM expired and was changed and 2hr warm up and one more hr charge transmitter (3hr no sensor)

7:15 PM CKM 1.0 ketone alarm
7:30 PM Alarm still >1 approaching 1.5 – gave insulin bolus via pump
8:00 PM ketones 2.0
9:00 PM >3.1 CKM **alarm** (capillary glucose 319 mg/dL (17.7 mmol/L)

CGM started to work
9:30 PM noted pump cannula site noted to be dislodged
By 10PM replaced cannula and gave insulin via pump
By MN – ketones falling. Glucose and ketones normalized over 4-5 hrs.

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In Conclusion

Dual Glucose Ketone continuous monitoring has transformed DKA-Prevention…step by step

We have the potential to see this headline in a few years --- IF:

1. DKA is recognized as a **clinical problem** ☐
2. We can **accurately** measure ketones and glucose … **iCGM status** ☐
3. **Approval** by regulators (FDA, CE Mark) ☐
4. We can identify people/populations **most likely to benefit** ☐
5. **Easy to start and wear** ☐
6. Data is **actionable by patients** ☐
7. Data is **actionable by clinicians** ☐
8. DGK In the **Standards of Care** and Covered by ***Insurance*** ☐

THANK YOU

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CGM-Mediated Improvements in HbA1c and Noninsulin Regimen Adherence

Prof. Monika Kellerer, MD, PhD
Medical Director
Clinic for Internal Medicine 1
Marienhospital Stuttgart
Germany

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Disclosure

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  Amgen, Abbott Diabetes Care, ASTRA Zeneca, Bayer AG, BMS, Boehringer Ingelheim, Lilly Diabetes, MSD, MedLearning, Novartis, Novo Nordisk, Roche Diabetes Care, Sanofi, SCIARC

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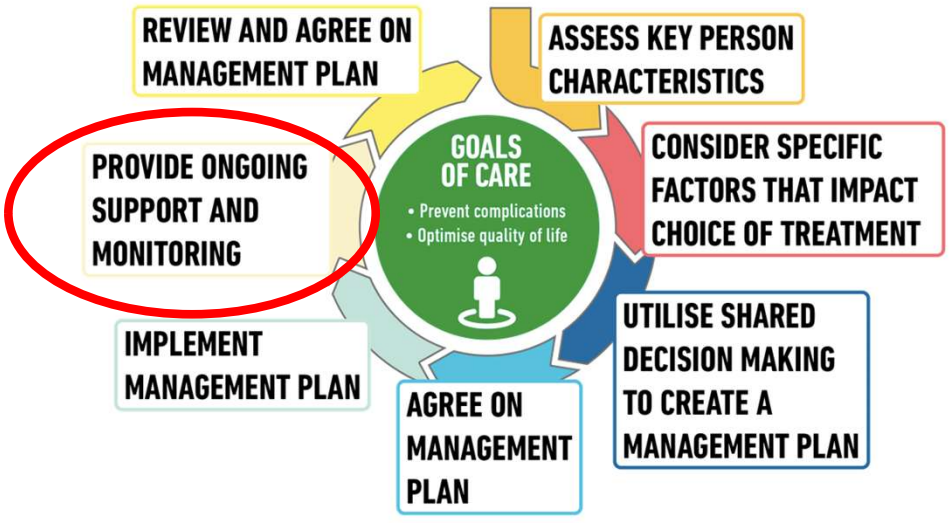
Person-Centered Glycemic Management in Type 2 Diabetes



Davies MJ, Aroda VR, Collins BS, Gabbay RA, Green J, Maruthur NM, Rosas SE, Del Prato S, Mathieu C, Mingrone G, Rossing P, Tankova T, Tsapas A, Buse JB *Diabetes Care* 2022; https://doi.org/10.2337/dci22-0034. *Diabetologia* 2022; https://doi.org/10.1007/s00125-022-05787-

Joint Consensus Report ADA/EASD 2022—Management of Hyperglycaemia in Type 2 Diabetes

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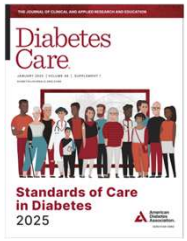
Place of Diabetes Technology in T2D
ADA and EASD Recommendations

- Technology can be useful in people with type 2 diabetes, but needs to be part of an holistic plan of care and supported by DSMES.



- Recommend real-time CGM (rtCGM) or intermittently scanned CGM (isCGM) for diabetes management to youth and adults with diabetes on any type of insulin therapy.
- Consider using rtCGM and isCGM in adults with type 2 diabetes treated with glucose-lowering medications other than insulin to achieve and maintain individualized glycemic goals.
- In circumstances when consistent use of CGM is not feasible, consider periodic use of personal or professional CGM to adjust medication and/or lifestyle.

Davies MJ, Aroda VR, Collins BS, Gabbay RA, Green J, Maruthur NM, Rosas SE, Del Prato S, Mathieu C, Mingrone G, Rossing P, Tankova T, Tsapas A, Buse JB Diabetes Care 2022; https://doi.org/10.2337/dci22-0034. Diabetologia 2022; https://doi.org/10.1007/s00125-022-05787- Joint Consensus Report ADA/EASD 2022—Management of Hyperglycaemia in Type 2 Diabetes

Professional Practice Recommendations, Diabetes Care Volume 48, Supplement 1, January 2025

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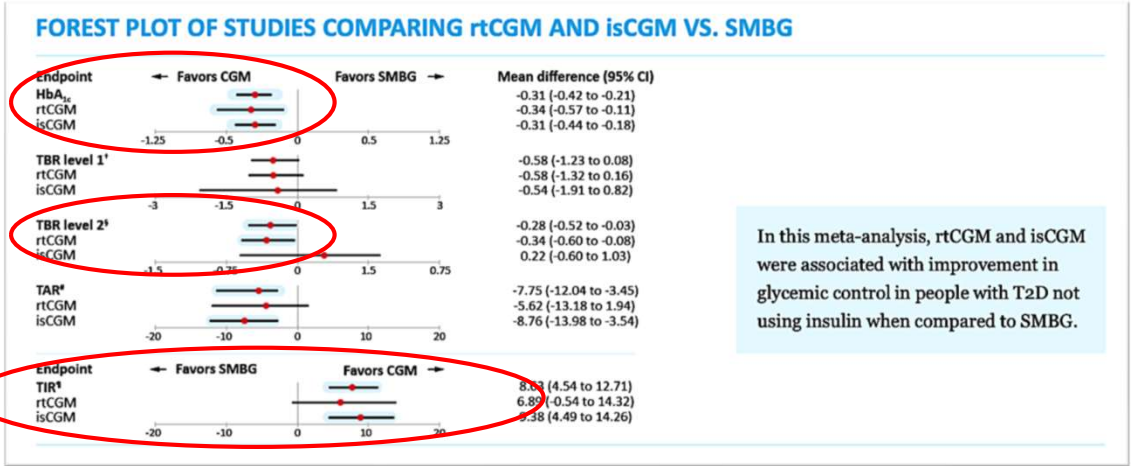
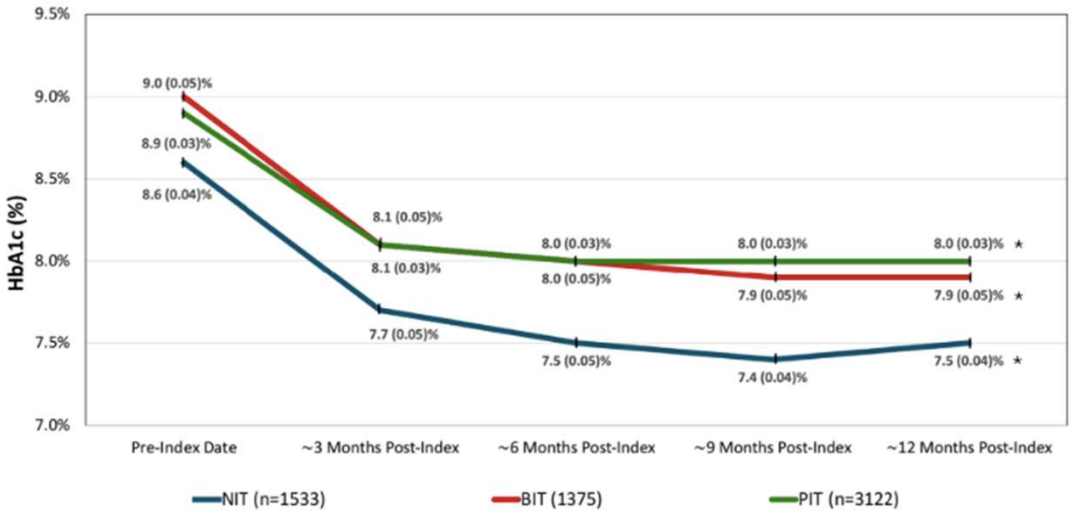
Meta-Analysis Comparing CGM vs. SMBG in T2D Without Insulin Treatment



¶ 70–180 mg/dL (3.9–10.0 mmol/mol), § <50 or <54 mg/dL (<2.8 or <3.0 mmol/L); † <70 mg/dL (<3.0 mmol/L); # >180 mg/dL (>10.0 mmol/L);
Oliva Morgado Ferreira R et al., Diabetes Technol Ther. 2023. doi: 10.1089/dia.2023.0390

38

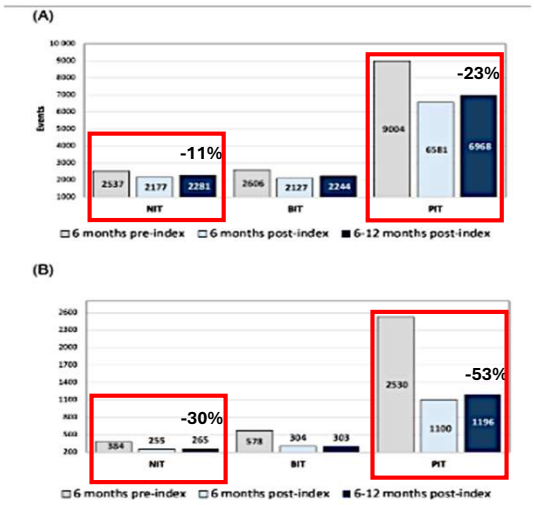
Impact of CGM on Glucose Control in People with T2D With or Without Insulin



Garg et al., Diabetes Obes Metab. 2024;26:5202–5210

39

Impact of CGM on Hospitalization Before and After Initiation of CGM in People with T2D With or Without Insulin



Hospitalization

All-cause

Acute diabetes related

Garg et al., Diabetes Obes Metab. 2024;26:5202–5210

40

Health Care Utilization After CGM Initiation Over 12 Months in T2D With and Without Insulin

TABLE 4 12-Month Change in Health Care Resource Utilization by Patient Group

Variable	T1D n=1,926			T2D IIT n=2,934			T2D NIIT n=893			T2D NIT n=1,583		
	Baseline, n (%)	Follow-up, n (%)	Relative change, %	Baseline, n (%)	Follow-up, n (%)	Relative change, %	Baseline, n (%)	Follow-up, n (%)	Relative change, %	Baseline, n (%)	Follow-up, n (%)	Relative change, %
Patients with hospital admissions												
All-cause	324 (16.8)	150 (7.8)	−54[a]	684 (23.3)	512 (17.5)	−25[b]	41 (15.8)	111 (12.4)	−21[c]	199 (12.6)	163 (10.3)	−18
Diabetes-related	204 (10.6)	51 (2.7)	−75[b]	105 (3.6)	50 (1.7)	−52[b]	24 (2.7)	9 (1.0)	−63[a]	29 (1.8)	10 (0.6)	−66[a]
Patients with emergency department visits												
All-cause	448 (23.3)	367 (19.1)	−18[a]	945 (32.2)	910 (31.0)	−4	250 (28.0)	248 (27.8)	−1	406 (25.7)	373 (23.6)	−8
Diabetes-related	163 (8.5)	80 (4.2)	−51[b]	132 (4.5)	93 (3.2)	−30[c]	39 (4.4)	22 (2.5)	−44[c]	48 (3.0)	35 (2.2)	−27
Patients with hospital admissions or emergency department visits for diabetes-related complications												
Hyperglycemia	92 (4.8)	30 (1.6)	−67[b]	72 (2.5)	35 (1.2)	−51[a]	27 (3.0)	10 (1.1)	−63[c]	29 (1.8)	15 (0.9)	−48[c]
Hypoglycemia	50 (2.6)	26 (1.4)	−48[b]	50 (1.7)	35 (1.2)	−30	7 (0.8)	9 (1.0)	+29	14 (0.9)	9 (0.6)	−36
Diabetic ketoacidosis	160 (8.3)	46 (2.4)	−71[c]	6 (0.2)	3 (0.1)	−50	1 (0.1)	0 (0.0)	—	1 (0.1)	0 (0.0)	—
Microvascular events	96 (5.0)	40 (2.1)	−58[b]	89 (3.0)	50 (1.7)	−44[a]	30 (3.4)	14 (1.6)	−53[c]	35 (2.2)	18 (1.1)	−49[c]
Macrovascular events	92 (4.8)	29 (1.5)	−68[b]	76 (2.6)	39 (1.3)	−49[a]	29 (3.3)	12 (1.3)	−59[c]	30 (1.9)	19 (1.2)	−37
Other	4 (0.2)	8 (0.4)	+100	34 (1.2)	32 (1.1)	−6	8 (0.9)	5 (0.6)	−38	10 (0.6)	10 (0.6)	—

Norman GJ et al., J Manag Care Spec Pharm. 2025; 31(1):15-24. doi: 10.18553/jmcp.2024.24255

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EASD 2025 Late-Breaking Abstract

EASD 2025 VIENNA

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CGM for People with T2DM not on Insulin— Budget Impact Analysis from a Medicaid Perspective

- This analysis explored the financial impact over a three-year timespan from a Medicaid perspective covering approximately 72 million lives.
- Difference in event rates reduction of ACH associated with CGM when compared to SMBG is 1.5 events for MDI users, 0.6 events for basal insulin users, and 0.4 events in non-insulin users.
- For acute, diabetes-related ER visits, the difference in event rates reduction associated with CGM when compared to SMBG is 2.4 events in MDI users, 1.1 events for basal insulin users, and 0.7 events in non-insulin users
- From a Medicaid perspective, expansion of CGM reimbursement to all patients with T2DM including non-insulin therapy, when projected at a 15% increase in CGM users from the previous year, was associated a cumulative **cost savings of $1.7 billion with 143,000 hospitalizations avoided over 3 years.**
- These net savings are largely due to inpatient hospitalizations avoided when a patient switches from SMBG to CGM use.

Wright E, et al. EASD 2025

Conclusion

At $12,880 per ACH stay among patients with T2DM, all-cause hospitalization was the major cost-driver on Medicaid's budget. CGM coverage for beneficiaries with T2DM including those on non-insulin therapy resulted in cost savings from the perspective of Medicaid in the US.

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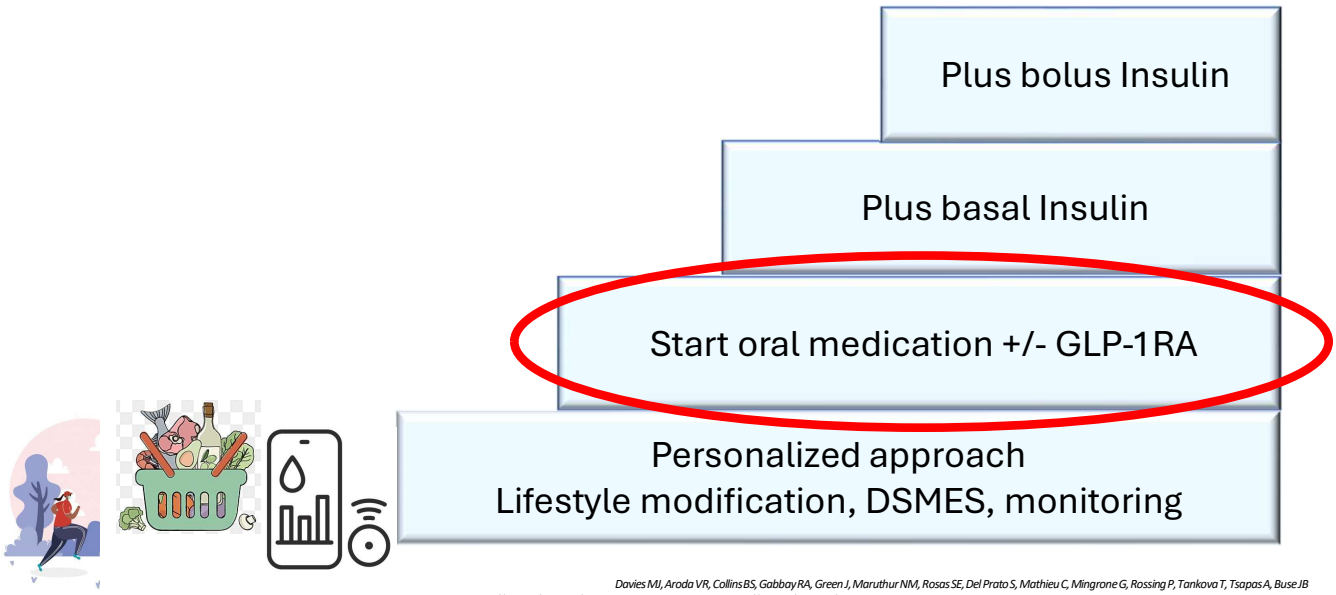
Glucose Management in Type 2 Diabetes

Stepwise Approach



Davies MJ, Aroda VR, Collins BS, Gabbay RA, Green J, Maruthur NM, Rosas SE, Del Prato S, Mathieu C, Mingrone G, Rossing P, Tankova T, Tsapas A, Buse JB Diabetes Care 2022; https://doi.org/10.2337/dci22-0034. Diabetologia 2022; https://doi.org/10.1007/s00125-022-05787- Joint Consensus Report ADA/EASD 2022—Management of Hyperglycaemia in Type 2 Diabetes

Professional Practice Recommendations, Diabetes Care Volume 48, Supplement 1, January 2025

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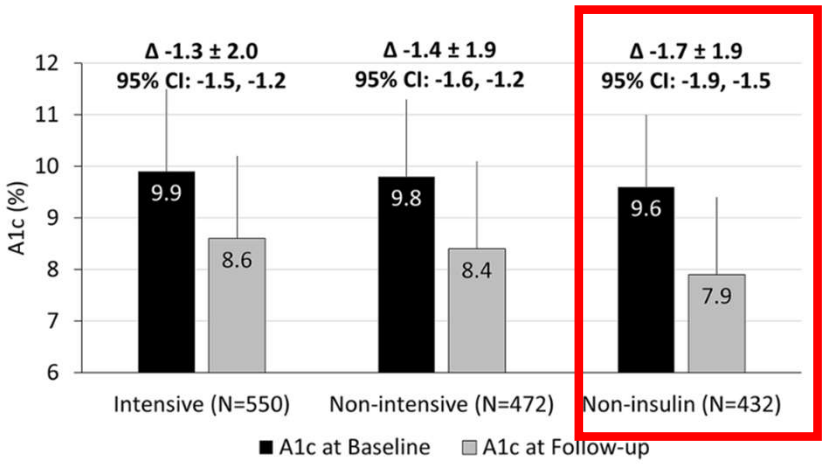
Place of CGM in the Background of GLP-1R Agonists

Effects are Consistent in T2D Taking GLP-1RA Together with Different Insulin Regimens



Miller et al., Diabetes Ther (2024) 15:2027–2038 https://doi.org/10.1007/s13300-024-01619-1

45

Initiating GLP-1 Therapy in Combination with CGM (FreeStyle Libre)

Provides Greater Benefit Compared with GLP-1 Therapy Alone

Geography	US		
Population	Total: N = 24,724 GLP-1 RA: n = 24,246 GLP-1 RA+FSL n = 478	T2D on GLP-1 RA with HbA_{1c} ≥8 %	Age: ≥18
Endpoints	• Comparison of paired changes in HbA_{1c} between unmatched and matched groups at 6 months		
Design	• Real-world, retrospective, observational study (First medication of GLP-1 RA: 2018–2022) • Data source: Optum's de-identified Market Clarity Data • Matching cohort: ratio 1:5; on age, sex, baseline HbA_{1c}, insulin type, first GLP-1 RA medication		

Wright et al., Diabetes Technology & Therapeutics Vol. 26, No. 10. https://doi.org/10.1089/dia.2024.0015

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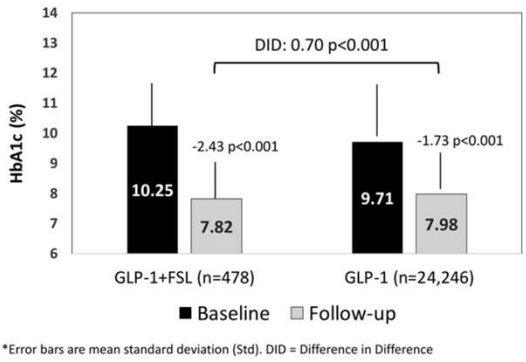
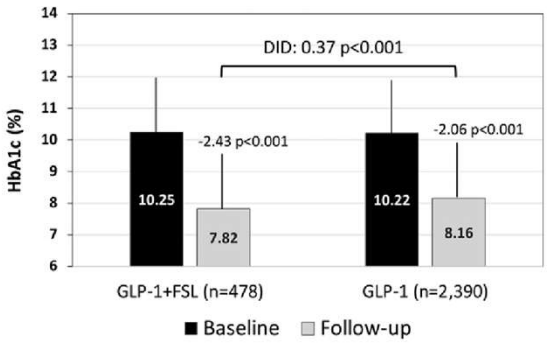
Initiating GLP-1 Therapy in Combination with CGM (FreeStyle Libre) Provides Greater Benefit Compared with GLP-1 Therapy Alone



*Error bars are mean standard deviation (Std). DID = Difference in Difference



Wright et al., Diabetes Technology & Therapeutics Vol. 26, No. 10. https://doi.org/10.1089/dia.2024.0015

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Interim Summary

- Initiation of CGM improves HbA_{1c} and TiR levels in T2D irrespective whether they are on insulin treatment or not.
- Adults with T2D and prior GLP-1 RA therapy experienced significant improvements in HbA_{1c} 6 months after initiating CGM (FSL).
- If people with T2D initiate GLP-1 RA treatment **together** with CGM (FSL), they achieve better HbA_{1c} values compared to those treated with GLP-1 RA only.

Miller et al., Diabetes Ther (2024) 15:2027–2038 https://doi.org/10.1007/s13300-024-01619-1; Garg et al., Diabetes Obes Metab. 2024;26:5202-5210; Wright et al., Diabetes Technology & Therapeutics Vol. 26, No. 10. https://doi.org/10.1089/dia.2024.0015

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Adherence with CGM-Based Therapy

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EASD 2025 Late-Breaking Abstract

EASD 2025 VIENNA

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Clinical Burden Associated with Type 2 Diabetes in France: An Update from the National Insurance Claim Database

- The ESND sample provides a representative overview of the T2DM population in France.
- The incidence of hospital stays for coronary revascularization, unstable angina pectoris, transient ischemic attack, heart failure, myocardial infarction, stroke, arteriopathy of the lower limbs, lower limb amputation and end-stage renal failure were respectively 3.8%, 0.9%, 0.6%, 2.5%, 2.4%, 2.1%, 1.8%, 0.5%, and 3.0% in the T2DM cohort.
- The standardized relative risks of macro and microvascular complications were higher in the T2DM group.
- Compared to 2013 data, distribution of patients across treatment lines was consistent, counting 40% on monotherapy, 24.8% on bi-therapy, 13% on triple therapy, and 20.3% on insulin (including 11.2% on basal insulin).
- SGLT2i were prescribed in 9.9% of patients, GLP1-RA in 17%, and CGM in 5.6% respectively. 65% of patients maintained the same pharmaceutical treatment regimen throughout 2022.

Riveline, J-P, et al. EASD 2025

Conclusion

T2DM patients have higher risk of micro and macro vascular complications compared to non-diabetic population. Treatment inertia is a major challenge in diabetes management, increasing the risk of future complications.

Expanding access to new treatments, including CGM, could reduce treatment inertia and improve clinical outcomes for the T2DM population

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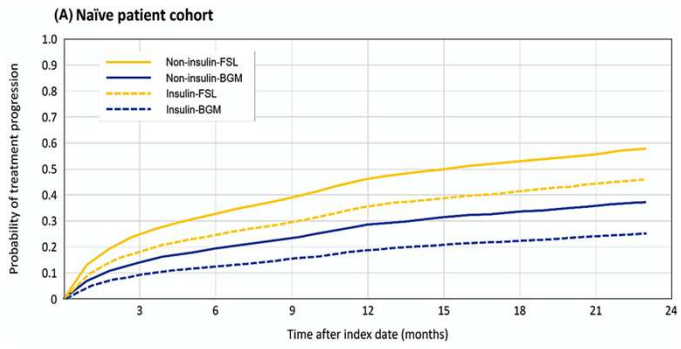
Place of CGM to Improve Therapeutic Ineritia in Type 2 Diabetes

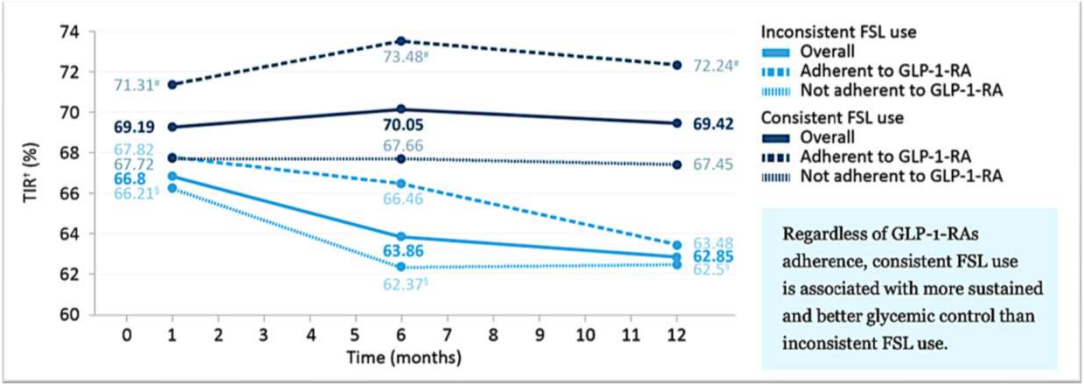


- PwT2D using FSL had a greater probability for treatment progression.
- Thus, CGM may be useful to improve therapeutic inertia in PwT2D

Harris et al, Diabetes Obesity Metabolism, Volume: 25, Issue: 6, Pages: 1704-1713, First published: 21 February 2023, DOI: (10.1111/dom.15025)

52

Mean TIR† From Baseline To 12 Months, By GLP-1-RA Adherence and CGM Utilization



† 70–180 mg/dL (3.0–10.0 mmol/L); Adherent: >80% PDC
GLP-1-RAs = Glucagon-Like Peptide-1 Receptor Agonists; PDC = Proportion of Days Covered (with FSL glucose reading or proportion of days' supply for all fills of GLP-1RAs, respectively, within 12 months post FSL initiation)
Huang E et al., ADA 2024, Diabetes 2024;73(Supplement_1):1917-LB.

53

Continuous Glucose Monitoring as a Behavior Modification Tool

1) While using continuous glucose monitoring (CGM) did you notice how different food choices affected blood sugar?
__Yes __No __I do not know

2) After CGM use, do you feel that you:
__ Limited sugared beverages
__ Excluded sugared beverages
__ Made no changes to sugared beverage choices
__ I never drank sugared beverages prior to CGM use

3) After CGM use, do you feel that you excluded or limited rice?
__Yes __No __I excluded rice prior to CGM use

4) After CGM use, do you feel that you excluded or limited cereal?
__Yes __No __I excluded cereal prior to CGM use

5) After CGM use, do you feel that you read labels for fiber content more?
__Yes __No __I already looked at fiber content __I do not know

6) Are there any foods you limited or excluded after CGM use? Please list up to your top three or write "none." _____

7) Do you think CGM use made you more likely to be more active/increase your exercise?
__Yes __No __I was already very active __I do not know

8) Were you more likely to go for a walk or do physical activity after a meal if you saw rising blood sugars on your CGM device?
__Yes __No __I already walked or was more active after meals __I do not know

9) Overall, do you feel that CGM use contributed to you making changes for a healthier lifestyle?
__Yes __No __I do not know

CGM Questionnaire

- 18 item questionnaire
- Current CGM users with any type of diabetes have been interviewed to determine their perceptions of how CGM affects their nutrition and physical activity choices.

Ehrhardt N and Zaghal Al, Clinical Diabetes, 2020; 38(2): 126-131

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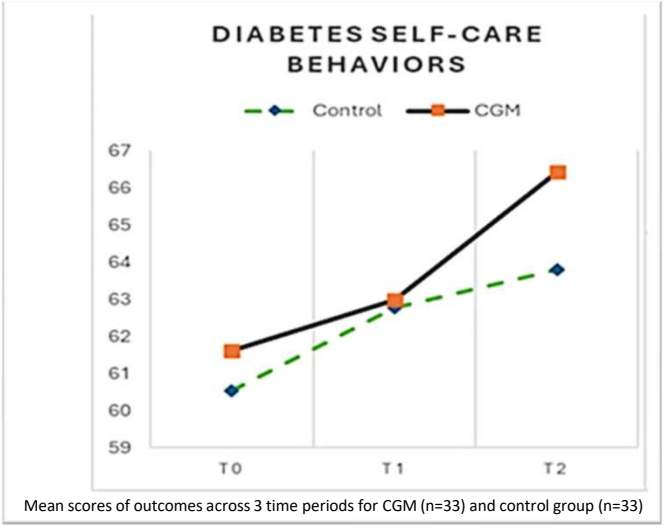
Continuous Glucose Monitoring as a Behavior Modification Tool

- 90% of continuous glucose monitoring (CGM) users felt that its use contributed to a healthier lifestyle
- 47% of CGM users reported being more likely to go for a walk or do physical activity if they saw a rise in their glucose levels
- 87% of CGM useres felt that they modified their food choices based on CGM use

Ehrhardt N and Zaghal Al, Clinical Diabetes, 2020; 38(2): 126-131

55

Impact of CGM on Diabetes Self-Care Behaviours (RCT)



Mean scores of outcomes across 3 time periods for CGM (n=33) and control group (n=33)

Chang, H.-Y. et al., The Impact ofS elf-Regulation Education Combined with Continuous Glucose Monitoring (CGM) on Diabetes Outcomes: A Randomized Controlled Study. Nurs. Rep. 2025, 15, 94
T1: 8 days, T2: 3 months

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EASD 2025 Late-Breaking Abstract

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Addressing the Shortfalls of GMI and HbA1c: Validation of Updated GMI and Personalized A1c

- A 26-week study of adults with T1D or T2D collected CGM data throughout and HbA1c every 2 weeks
- HbA1c-GMI regression slope was 25% above unity, which improved with uGMI to within 3% of unity
- GMI-HbA1c and uGMI-HbA1c correlations demonstrating modest agreement (R2=0.81 both) and large spread as shown by wide prediction intervals.
- Use of pA1c reduced data spread with pA1C-uGMI showing improved correlations (R^2=0.93) while maintaining near unity slope.
- These findings were consistent in those **with T2D, who would particularly benefit from using pA1c rather than HbA1c, as uninterrupted CGM is not routinely used in this population**.

Ajjan R, et al. EASD 2025

Conclusion

The updated GMI improves the alignment with HbA1c and alleviates concerns in relation to over- and under-estimating HbA1c in cohort level, while **personalized A1C improves the correlation with this CGM-derived metric** by adjusting for variability in red blood cell physiology.

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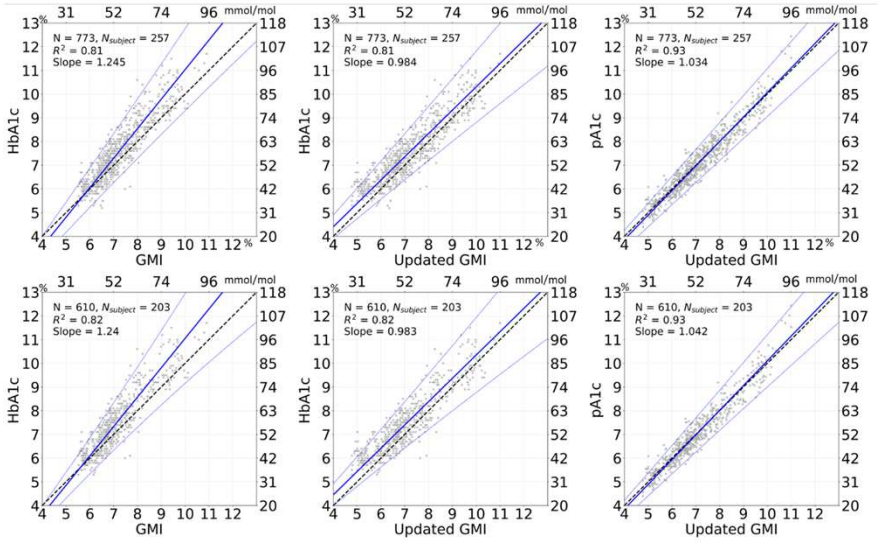
Addressing the Shortfalls of GMI and HbA1c: Validation of Updated GMI and Personalized A1c

HbA1c, GMI, Updated GMI and pA1C Regressions in the GDAC Study



Ajjan R, et al. EASD 2025

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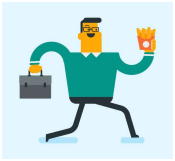
Summary

- Initiation of CGM improves HbA_{1c} and TiR levels in T2D irrespective whether they are on insulin treatment or not.
- Adults with T2D and prior GLP-1 RA therapy experienced significant improvements in HbA_{1c} 6 months after initiating CGM (FSL).
- If people with T2D initiate GLP-1 RA treatment **together** with CGM (FSL), they achieve better HbA_{1c} values compared to those treated with GLP-1 RA only.
- **CGM has shown to be useful in reducing therapeutic inertia.**
- **CGM supports PwT2D to be more adherent to healthy lifestyle behavior.**

Miller et al., Diabetes Ther (2024) 15:2027–2038 https://doi.org/10.1007/s13300-024-01619-1; Garg et al., Diabetes Obes Metab. 2024;26:5202–5210; Wright et al., Diabetes Technology & Therapeutics Vol. 26, No. 10. https://doi.org/10.1089/dia.2024.0015; Harris et al, Diabetes Obesity Metabolism, Volume: 25, Issue: 6, Pages: 1704-1713, First published: 21 February 2023, DOI: (10.1111/dom.15025) ; Huang E et al., ADA 2024, Diabetes 2024;73(Supplement_1):1917-LB. ; Ehrhardt N and Zaghal Al, Clinical Diabetes, 2020; 38(2): 126-131; Chang et al., Nurs. Rep. 2025, 15, 94

60

Clinical Case Presentation



Peter is a 58 year old man

Medical history	Type 2 diabetes for 8 years
Co-Morbities	Diabetes complications: Peripheral polyneuropathy, CKD G2A2, fatty liver disease
Medications	• HbA1c 1 year ago was 7.5%, now it is 9.1% • Blood pressure: 126/74 mmHg • BMI: 30.7 kg/m2

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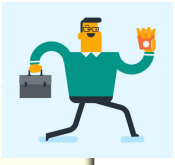
Clinical Case Presentation



Most recent antidiabetic medication:

- Metformin 1000mg BID
- Empagliflozin 10mg QD
- Semaglutide 1mg s.c. per week

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Clinical Case Presentation

Social:

- Married, works as an independent management consultant, does a lot of business traveling
- He attributes his worsening of glycemic control on his very irregular lifestyle. He eats rather unhealthy highly processed food during traveling.
- GLP-1RA injections occur irregularly (only when he is at home).
- Right now he is worried about his recent eye exam showing new onset diabetic retinopathy and he is motivated to get his blood sugar under control again

Glucose data were limited:

SMBG-values of the last 5 days: fasting: 230, 197, 250, 172, 205 mg/dl
12.8, 10.9, 13.9, 9.5, 11.4 mmol/l

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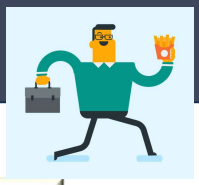
Clinical Case Presentation



Your Choice?

1) No change and wait – he might improve
2) Since he is not on target wit OAD and GLP1-RA start basal insulin
3) Re-evaluate lifestyle habits and give advice for improving glucose control
4) Get more information by introducing CGM

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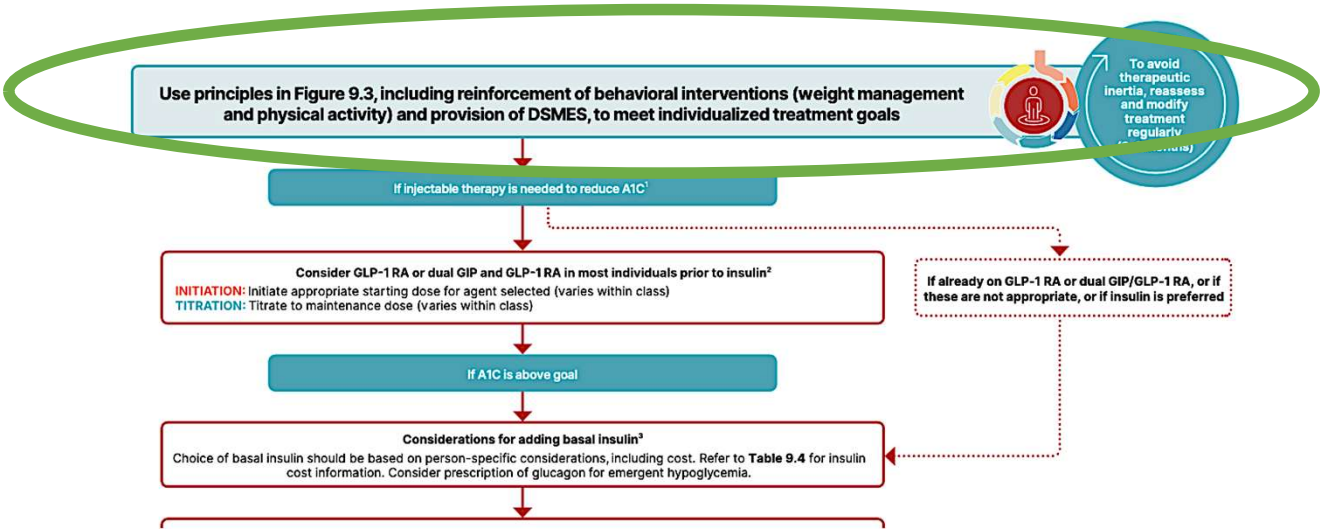
Reinforce Lifestyle Management Before Escalating Medical/Injectable Therapy



Davies MJ, Aroda VR, Collins BS, Gabbay RA, Green J, Maruthur NM, Rosas SE, Del Prato S, Mathieu C, Mingrone G, Rossing P, Tankova T, Tsapas A, Buse JB Diabetes Care 2022; https://doi.org/10.2337/dci22-0034. Diabetologia 2022; https://doi.org/10.1007/s00125-022-05787- Joint Consensus Report ADA/EASD 2022—Management of Hyperglycaemia in Type 2 Diabetes

Professional Practice Recommendations, Diabetes Care Volume 48, Supplement 1, January 2025

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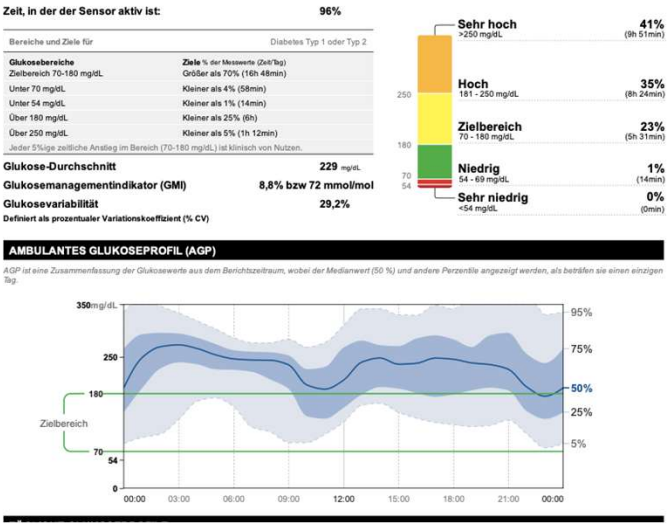
Clinical Case Presentation



2 week review with rtCGM

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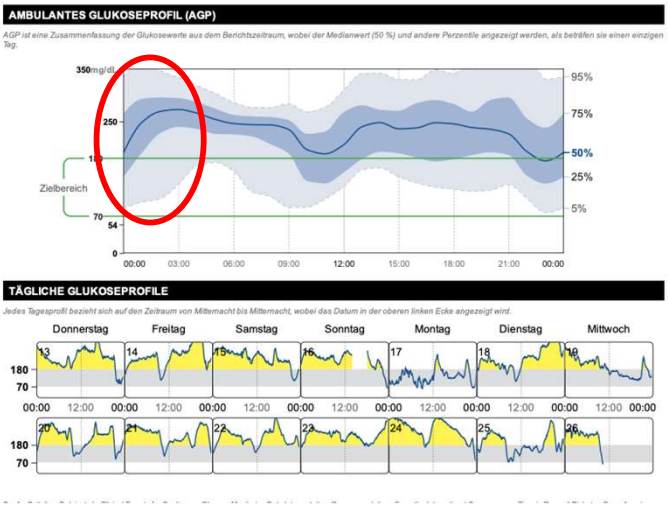
Clinical Case Presentation



Often stays in the hotel bar in the evening and snacks a lot

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Clinical Case Presentation

Your Recommendation?

1) Start with basal insulin to reduce high fasting levels
2) Discuss the CGM data with patient, show the influence of unhealthy lifestyle to make a change here
3) Switch to another GLP-1 RA

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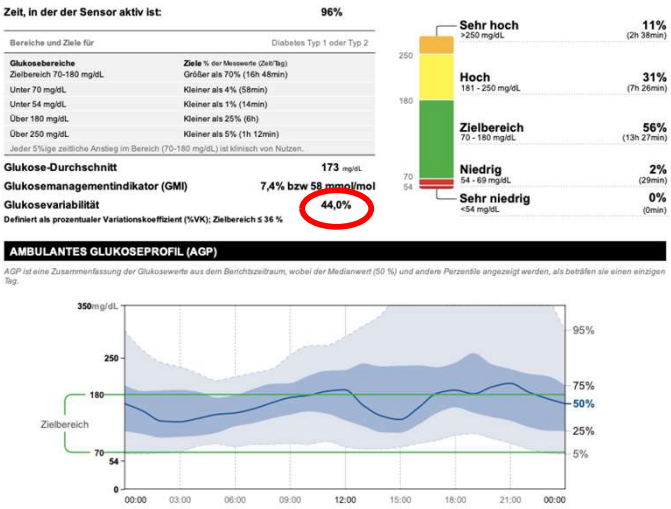
Clinical Case Presentation



Zeit, in der der Sensor aktiv ist:	96%

Bereiche und Ziele für	Diabetes Typ 1 oder Typ 2
Glukosebereiche Zielbereich 70-180 mg/dL	**Ziele** % der Messwerte (Zeit/Tag) Größer als 70% (16h 48min)
Unter 70 mg/dL	Kleiner als 4% (58min)
Unter 54 mg/dL	Kleiner als 1% (14min)
Über 180 mg/dL	Kleiner als 25% (6h)
Über 250 mg/dL	Kleiner als 5% (1h 12min)

Jeder 5%ige zeitliche Anstieg im Bereich (70-180 mg/dL) ist klinisch von Nutzen.

Glukose-Durchschnitt	173 mg/dL
Glukosemanagementindikator (GMI)	7,4% bzw 58 mmol/mol
Glukosevariabilität	44,0%

Definiert als prozentualer Variationskoeffizient (%VK); Zielbereich ≤ 36 %

Sehr hoch	>250 mg/dL	11% (2h 38min)
Hoch	181 - 250 mg/dL	31% (7h 26min)
Zielbereich	70 - 180 mg/dL	56% (13h 27min)
Niedrig	54 - 69 mg/dL	2% (29min)
Sehr niedrig	<54 mg/dL	0% (0min)

AMBULANTES GLUKOSEPROFIL (AGP)

AGP ist eine Zusammenfassung der Glukosewerte aus dem Berichtszeitraum, wobei der Medianwert (50 %) und andere Perzentile angezeigt werden, als beträfen sie einen einzigen Tag.

- Diabetes educators discussed CGM-profile, gave nutritional education, recommended Peter use the gym in the hotel and motivated patient by DSMES
- We did not switch GLP1-RA, but encouraged to inject it regularly.
- 4 weeks later:

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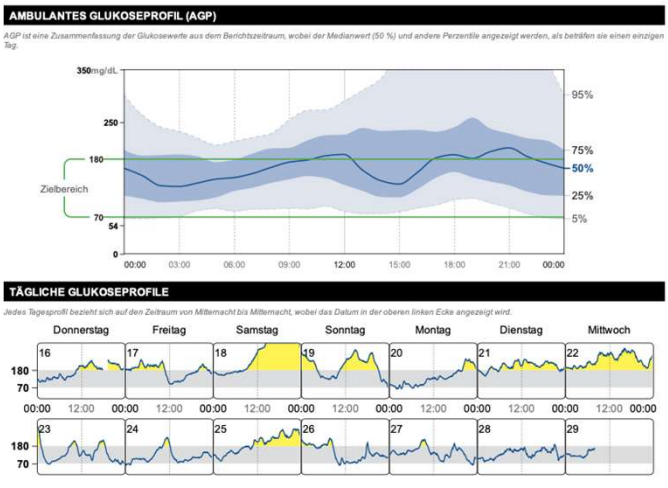
Clinical Case Presentation



AMBULANTES GLUKOSEPROFIL (AGP)

AGP ist eine Zusammenfassung der Glukosewerte aus dem Berichtszeitraum, wobei der Medianwert (50 %) und andere Perzentile angezeigt werden, als beträfen sie einen einzigen Tag.

TÄGLICHE GLUKOSEPROFILE

Jedes Tagesprofil bezieht sich auf den Zeitraum von Mitternacht bis Mitternacht, wobei das Datum in der oberen linken Ecke angezeigt wird.

- Diabetes educator: He is doing much better, they discussed recent CGM-profil with still high glucose variation during afternoon and evening.
- Patient is willing to try intermittant fasting (no food 5pm and later)
- 4 months later:

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Clinical Case Presentation

Significant Improvement Only With Lifestyle Changes Together With CGM and DSMES

GLUKOSESTATISTIK UND -ZIELE

15 Januar 2025 - 28 Januar 2025	14 Tage
Zeit, in der der Sensor aktiv ist:	91%

Bereiche und Ziele für	Diabetes Typ 1 oder Typ 2
Glukosebereiche Zielbereich 70-180 mg/dL	**Ziele** % der Messwerte (Zeit/Tag) Größer als 70% (16h 48min)
Unter 70 mg/dL	Kleiner als 4% (58min)
Unter 54 mg/dL	Kleiner als 1% (14min)
Über 180 mg/dL	Kleiner als 25% (6h)
Über 250 mg/dL	Kleiner als 5% (1h 12min)

Jeder 5%ige zeitliche Anstieg im Bereich (70-180 mg/dL) ist klinisch von Nutzen.

Glukose-Durchschnitt	119 mg/dL
Glukosemanagementindikator (GMI)	6,2% bzw 44 mmol/mol
Glukosevariabilität	30,4%

Definiert als prozentualer Variationskoeffizient (%VK); Zielbereich ≤ 36 %

ZEIT IN BEREICHEN

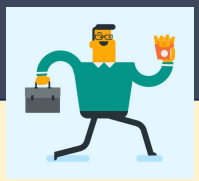
Sehr hoch	>250 mg/dL	0% (0min)
Hoch	181 - 250 mg/dL	6% (1h 26min)
Zielbereich	70 - 180 mg/dL	92% (22h 5min)
Niedrig	54 - 69 mg/dL	2% (29min)
Sehr niedrig	<54 mg/dL	0% (0min)

AMBULANTES GLUKOSEPROFIL (AGP)

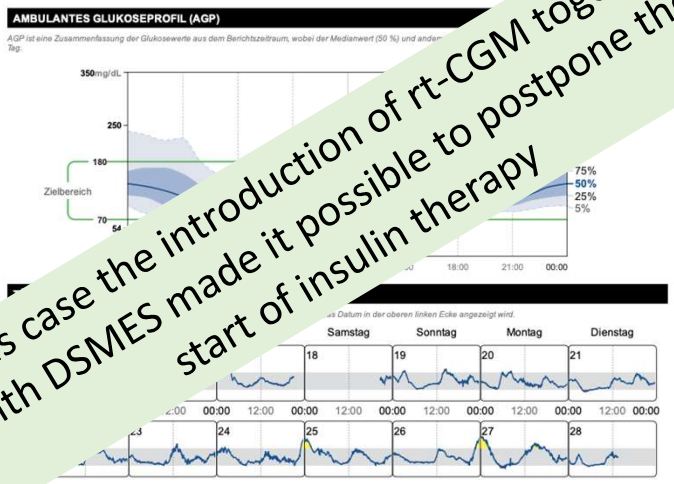
AGP ist eine Zusammenfassung der Glukosewerte aus dem Berichtszeitraum, wobei der Medianwert (50 %) und andere Perzentile angezeigt werden, als beträfen sie einen einzigen Tag.

71

Clinical Case Presentation



In his case the introduction of rt-CGM together with DSMES made it possible to postpone the start of insulin therapy



AMBULANTES GLUKOSEPROFIL (AGP)

Peter:

To be honest I never really liked to do the finger pricks and with CGM I got out so much more information about my glucose levels in every day life. With CGM I could see the tremendous influence of exercise and food in my case. That was really very helpful and changed my behaviour.

He successfully reduced weight by 6 kg and his last HbA1c was 6.9%.

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Thank you for your attention!

Monika Kellerer
Medical Director
Devision for Internal Medicine 1
Department for Diabetology and Endocrinology
Marienhospital Stuttgart
Germany

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The Foundational Role of CGM for Personalized HbA1c Optimization

Ramzi Ajjan, MD, PhD
Professor of Metabolic Medicine
University of Leeds and Leeds Teaching Hospitals Trust Leeds, United Kingdom

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Disclosures

Company Name	Honoraria/ Expenses	Consulting/ Advisory Board	Funded Research
Abbott	x	x	x
AstraZeneca	x	x	
Bayer	x	x	x
Boehringer Ingelheim	x	x	
Bristol-Myers Squibb	x	x	
Dexcom		x	
Eli Lilly	x	x	x
Glaxo SmithKline	x	x	
Menarini Pharmaceuticals	x	x	
Merck Sharp & Dohme	x	x	
NovoNordisk	x	x	x
Roche			x
Takeda	x	x	X

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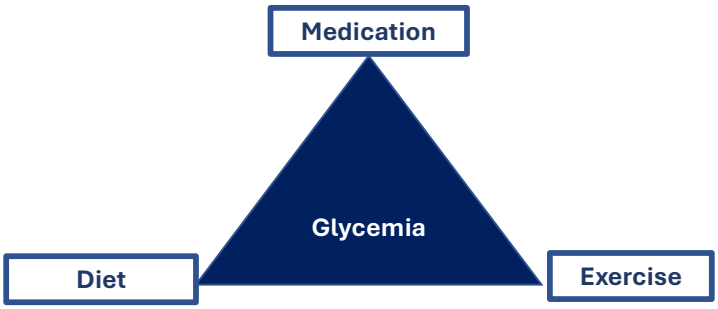
Managing Glycemia in Diabetes

In T2D

- Exercise
- Diet
- Medication



In T1D

- Medication (insulin)
- Exercise and diet also become important in those who develop features of insulin resistance

The problem: Hyperglycemia can be asymptomatic; no reaction to what you do not feel!

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CGM as a Behaviour Modification Tool

In 40 participants with insulin-treated diabetes (78% on pumps), a survey showed:

88% noticed that food choices affected glucose levels

43% reported being more active after CGM use (28% were already active and 23% no difference)

90% felt that CGM contributed to a healthier lifestyle

1) While using continuous glucose monitoring (CGM) did you notice how different food choices affected blood sugar?
__Yes __No __I do not know

2) After CGM use, do you feel that you:
__ Limited sugared beverages
__ Excluded sugared beverages
__ Made no changes to sugared beverage choices
__ I never drank sugared beverages prior to CGM use

3) After CGM use, do you feel that you excluded or limited rice?
__Yes __No __I excluded rice prior to CGM use

4) After CGM use, do you feel that you excluded or limited cereal?
__Yes __No __I excluded cereal prior to CGM use

5) After CGM use, do you feel that you read labels for fiber content more?
__Yes __No __I already looked at fiber content __I do not know

6) Are there any foods you limited or excluded after CGM use? Please list up to your top three or write "none." _____

7) Do you think CGM use made you more likely to be more active/increase your exercise?
__Yes __No __I was already very active __I do not know

8) Were you more likely to go for a walk or do physical activity after a meal if you saw rising blood sugars on your CGM device?
__Yes __No __I already walked or was more active after meals __I do not know

9) Overall, do you feel that CGM use contributed to you making changes for a healthier lifestyle?
__Yes __No __I do not know

Ehrhardt & Al-Zaghal, Clin Diab 2020; 38(2):126–131

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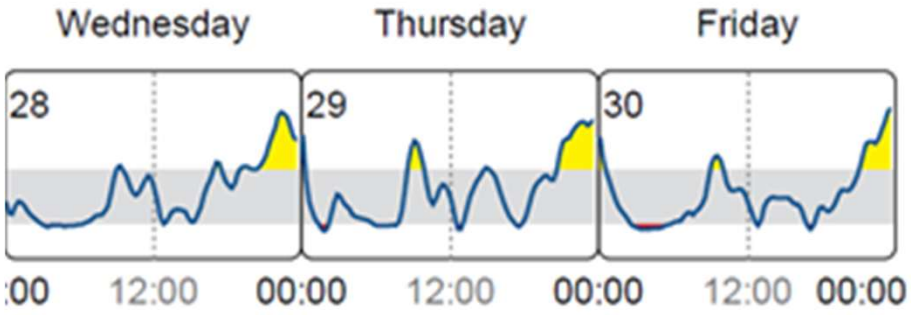
CGM and Food (The Banana Effect)



Data on file – Prof Ramzi Ajjan

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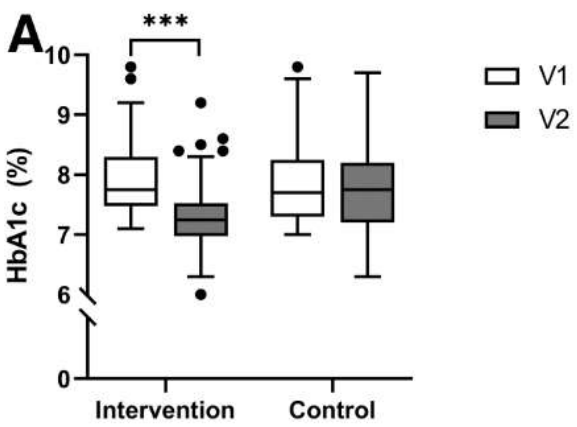
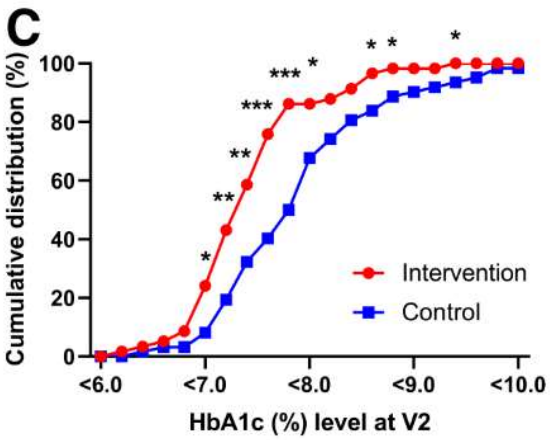
CGM in T2D Treated with OAD or Basal Insulin
PDF Trial

Motivate lifestyle modification through patient-driven healthier food choices

Korea, n=126, 3m
OAD and/or basal insulin (27.5%)
Structured education + isCGM vs Standard care with BGM
Mean Age 58, A1c 7.9%





Cheo HJ. et al., Diabetes Care. 2022; 45(10):2224-22

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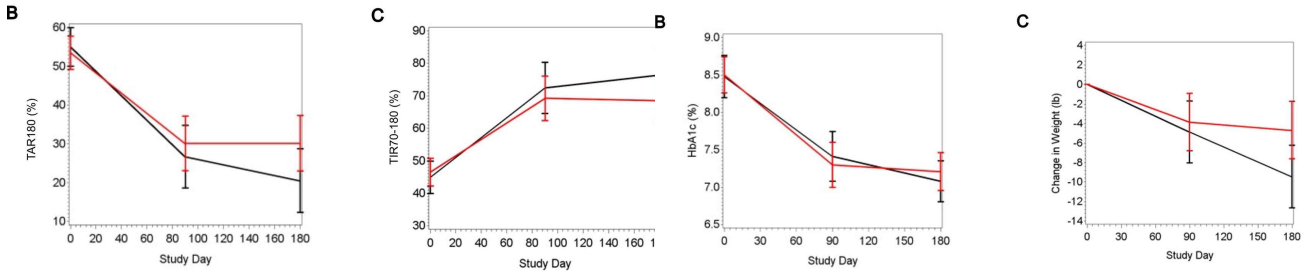
CGM and Glycemia

T2D patients not on insulin were randomised to:

- CGM alone (black lines; n=31) or CGM plus food diaries (red lines; n=41)
- 52% men, age<65 years 75%, white 71%
- No medication change in the first 3 months



Martens et al, Diab Technol Ther 2025, Epub; https://doi.org/10.1089/dia.2024.0579

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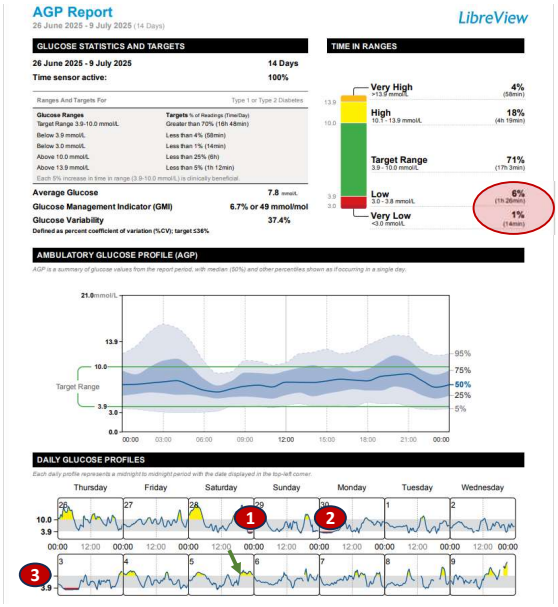
Clinical Case #1

Kaleb is 25 years old

Past medical history	• MDI-treated (not keen on a pump) • Seen in clinic and wanted to talk about hypos

1. Occurred due to overcorrection.
2. Overestimated bolus.
3. The one that scared me: “team building activities” (go-karting then a few drinks). Now I understand what alcohol can do to you, particularly when combined with activities.



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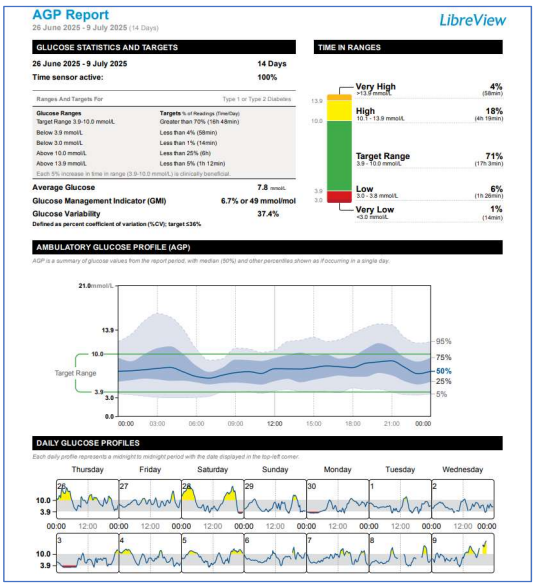
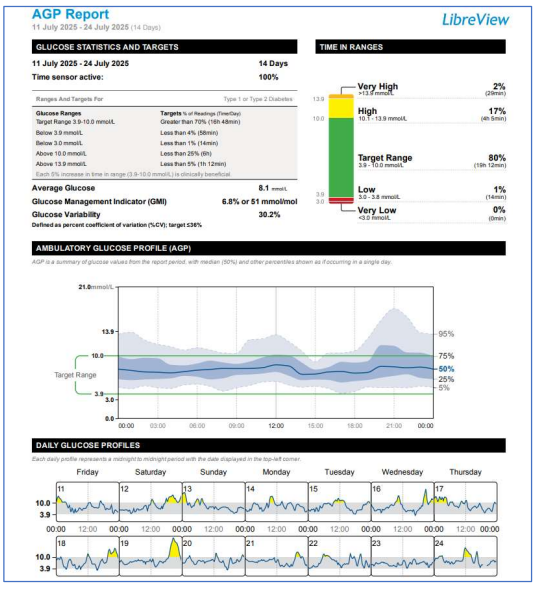
Clinical Case #1- Was This Maintained?





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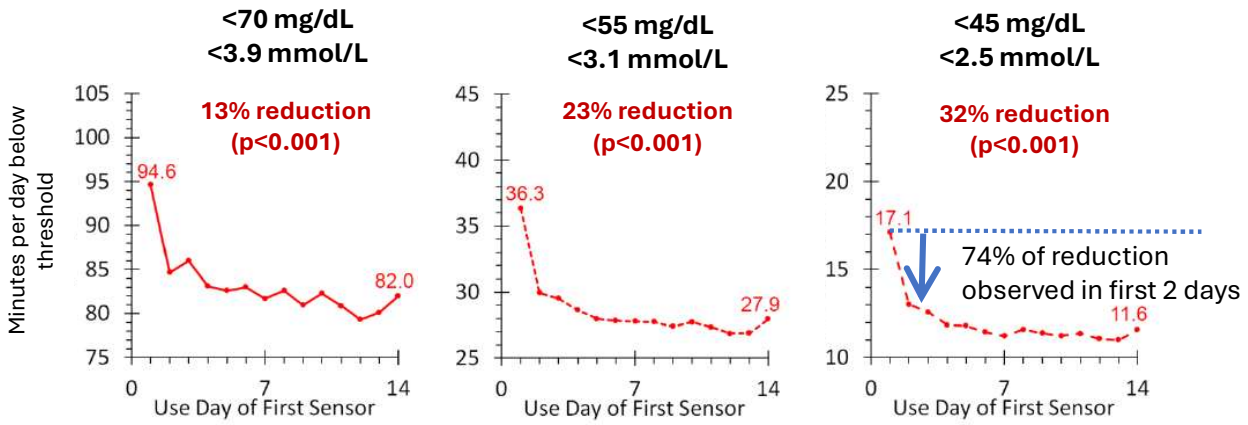
Changes in Hypoglycemia Following First CGM Use

Real-world: 1st sensor of 14,617 users



Dunn, et al. Diabetes Research and Clinical Practice, 2018

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Clinical Case #2

Ahmed is a 21 year old man

Medical history	Type 1 diabetes for 9 years
Co-Morbities	None (but patient is terrified of having future complications)
Medications	Glargine (30 units) and aspart (1.0-1.5 u:10 carbs); does not want a pump

- Weight 54 kg, BMI 21.2 kg/m2
- HbA1c 6.4% (47 mmol/mol)

- Says all is fine and hypoglycaemia is infrequent with good warnings

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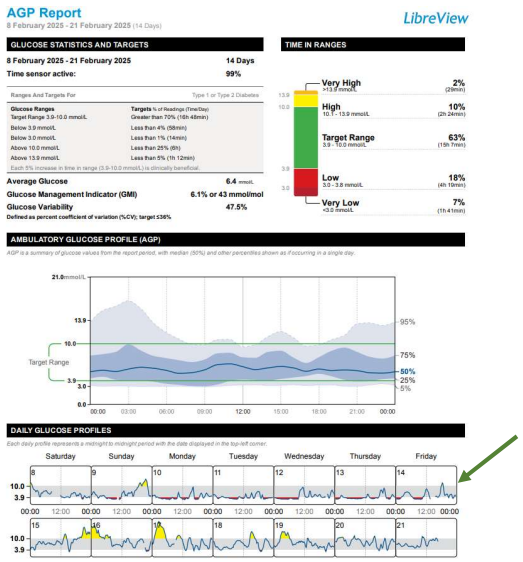
Clinical Case #2



Which of the followings is correct:

1) This is excellent control supported by GMI of 43 mmol/mol (6.1%)
2) Hypoglycaemia needs urgent attention
3) Hypoglycaemia is not an issue as it is clearly related to sensor compression
4) This is “pseudohypoglycaemia” as GV>45%

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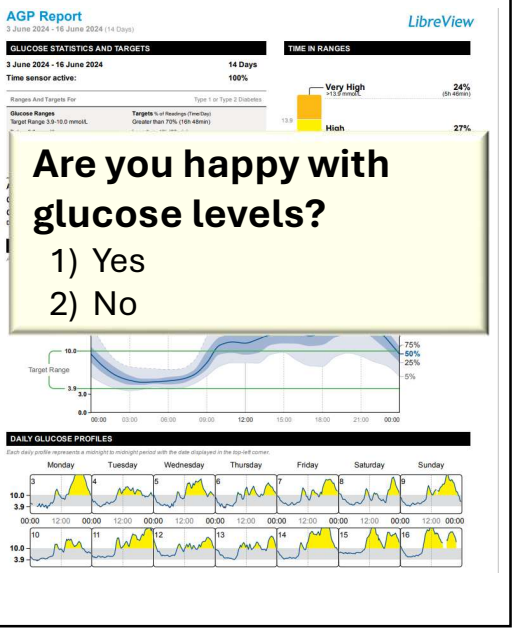
Clinical Case #3

Rosie is 67 years old

Past medical history	• Type 2 diabetes for 19 years • Strong FH of IHD
Measurements	• Weight 82 kg, BMI 30.3 kg/m2 • HbA1c 8.5% (69 mmol/mol)
Medications	• Humalog mix 25 bd (44 and 24 units) • Tirzepatide 5 mg/week • Empagliflozin 25 mg od • Metformin 1 gr bd



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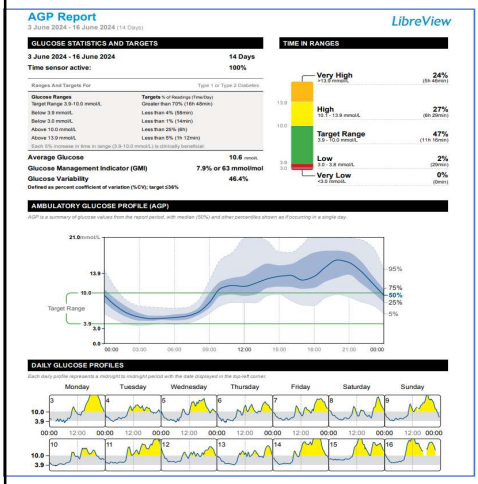
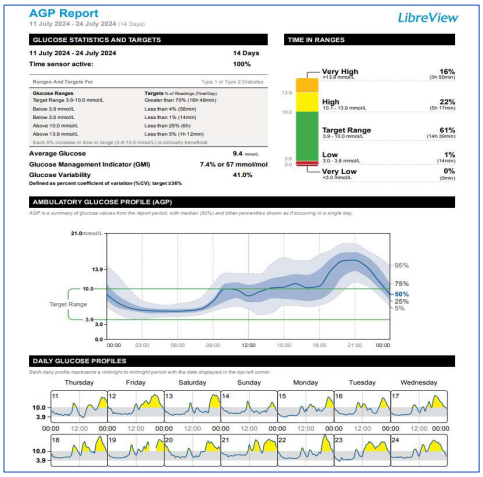
Clinical Case #3—Progress





Possibilities

1) Insulin dose was increased
2) Tirzepatide dose was increased
3) Patient is undertaking more exercise
4) 1 and 2

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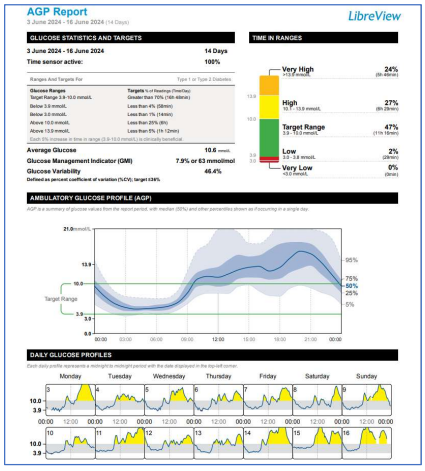
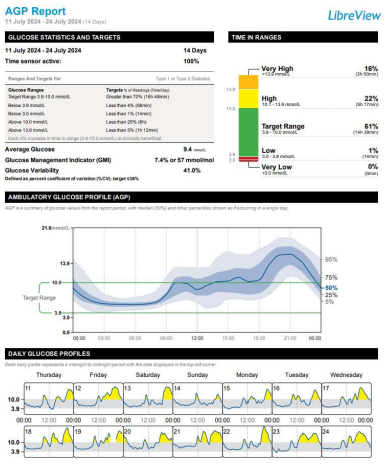
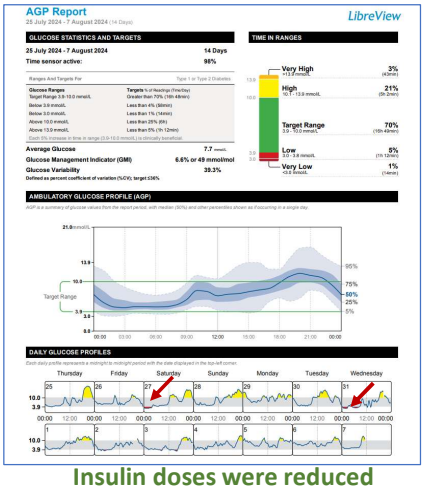
Clinical Case #3—Progress







Insulin doses were reduced

Take home message

Do not underestimate the role of exercise
(gentle and regular rather than intense and infrequent)

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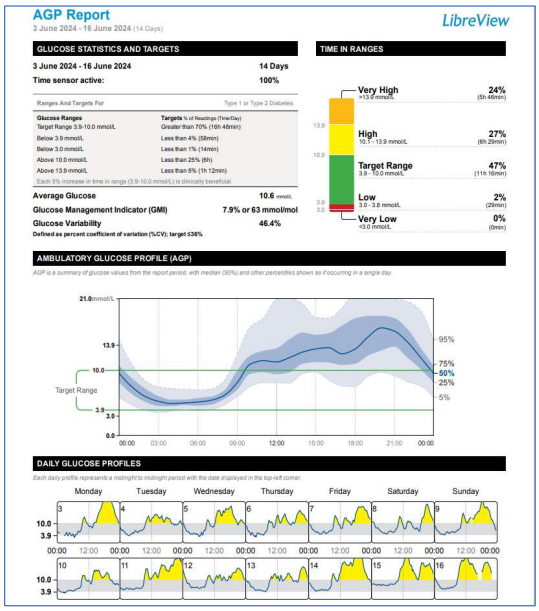
Clinical Case #3—one more thing…



This lady had an HbA1c of 8.5% (69 mmol/mol)

Looking at 90 days CGM prior to HbA1c, GMI was 7.8% (62 mmol/mol)

Shall I rely on GMI or HbA1c?

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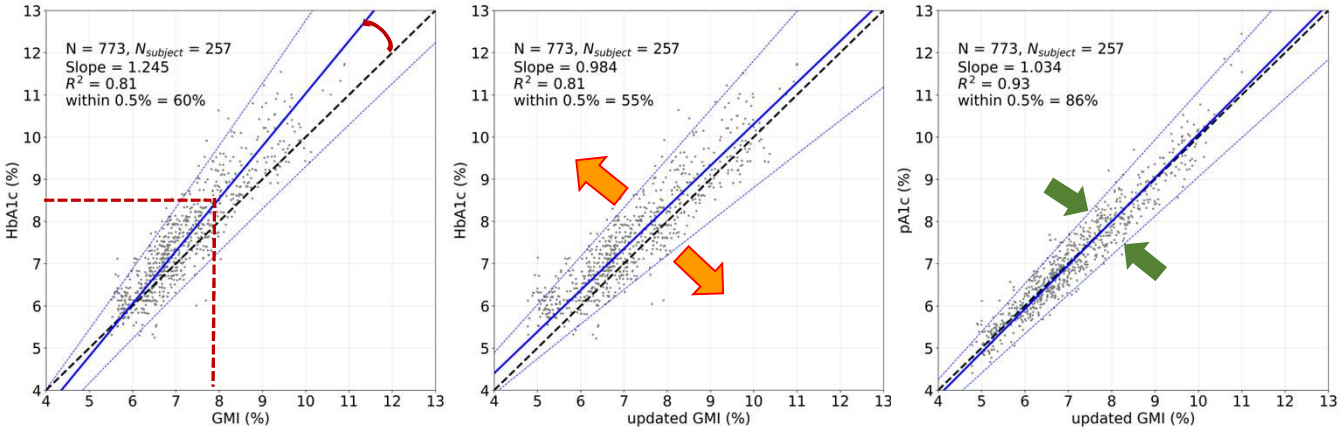
Addressing the Shortfalls of GMI and HbA1c: Validation of **Updated GMI** and **Personalized A1c**

Current GMI overestimates HbA1c at lower glucose and underestimates at higher glucose levels

Updated GMI formula fixes the "slope" but there is still a wide spread of data due to inter-individual RBC variability

Use of personalised A1c, that corrects for RBC differences between individuals, improves the relationship



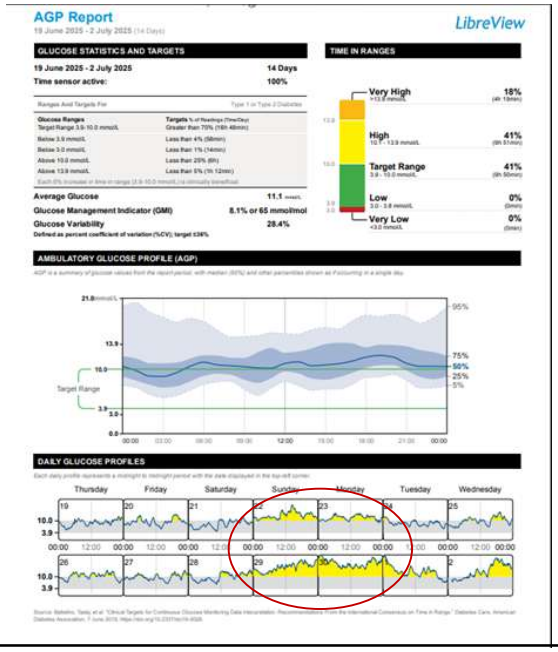
Ajjan R et al. GDAC strudy - EASD 2025, SO 089, Thursday; 12:45-13:45

90

Clinical Case #4

Dave is a 52-year-old man

Past medical history	Type 2 diabetes Works in a supermarket (shelving)
Medications	• Metformin 2 gr/day • Semaglutide 1 mg once/week • Insulin Glargine 34 units once/day
Background	• Works days Thursday-Saturday • Night-shift Tuesday-Wednesday



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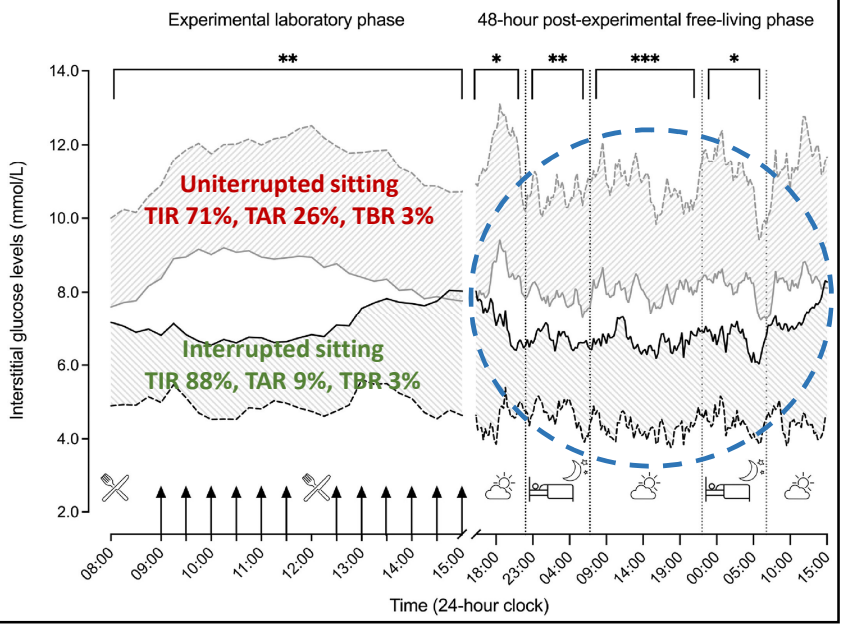
Exercise is Also Important in T1D

T1D (n=32, 17 females) randomised cross-over study with > 7d washout:

- Uninterrupted sitting for 7 hrs
- Interrupted sitting every 30 mins (3 mins walking)

HbA1c 68±2.3 mmol/mol (8.4%)



Campbell et al, Diab Obes Metab 2023; 25:3589-98

92

Clinical Case #5

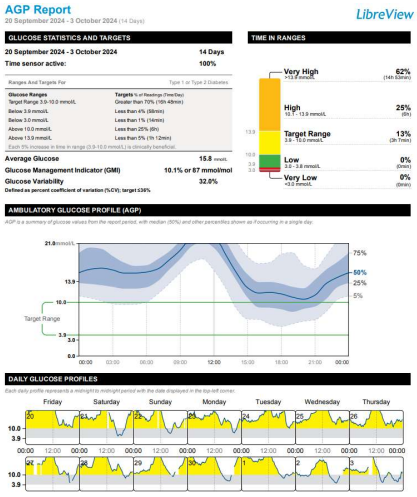
Keith is a 69-year-old man

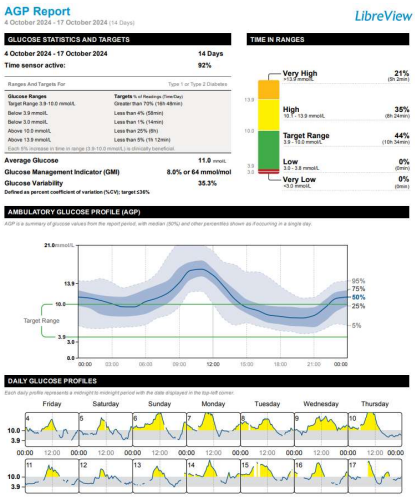
Past medical history	Type 2 diabetes
Medications	• Metformin • Sitagliptin • Dapagliflozin • Glargine (44 units)
Background	• Daily gardening, regular walks with the dog • W 77 kg, BMI 24.4 kg/m2

HbA1c past 2 years: >97 mmol/mol (>11%)

93

Clinical Case #5





Rapid improvement in glycaemia is due to:

1) Switching from gliptin to GLP-1RA
2) ↑basal insulin
3) Starting a sensor
4) Going go-karting
5) All of the above

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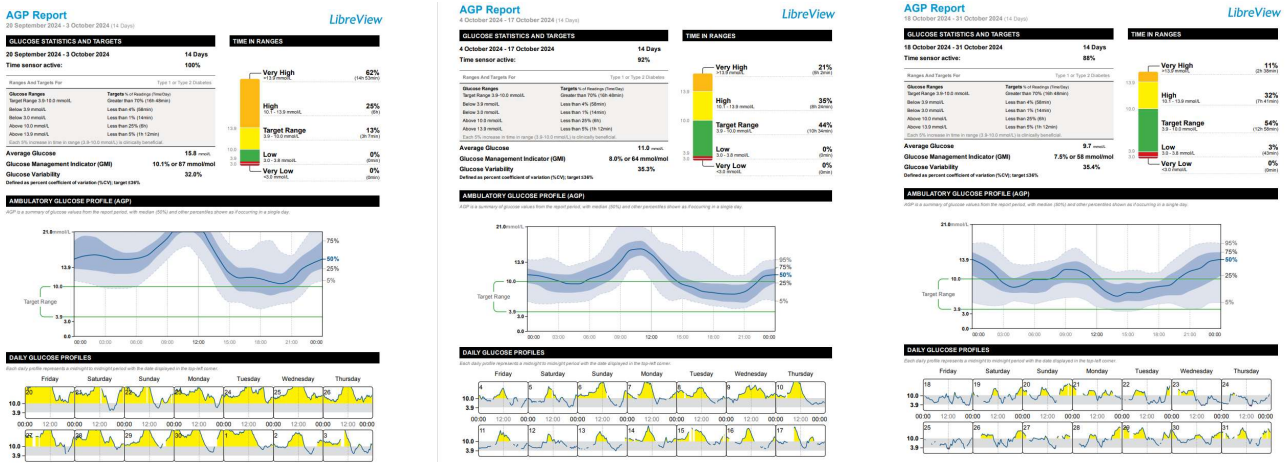
Clinical Case #5—Progress

Basal insulin is now 36 units (was on 44 units)



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EASD 2025 Late-Breaking Abstract

EASD 2025 VIENNA

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Clinical Burden Associated with Type 2 Diabetes in France: An Update from the National Insurance Claim Database

- The ESND sample provides a representative overview of the T2DM population in France.
- The incidence of hospital stays for macro and microvascular complications ranged from 0.5-3.8%.
- Compared to 2013 data, distribution of patients across treatment lines was consistent, counting 40% monotherapy, 25% dual-therapy, 13% triple therapy, and 20% insulin (including 11% on basal).
- SGLT2i were prescribed in 10% of patients, GLP1-RA in 17%, and CGM in 6%; 65% of patients maintained the same pharmaceutical treatment regimen throughout 2022.

Riveline J-P et al. EASD 2025 - SO 014, Tuesday; 13:15-14:15.

Conclusion

Hospitalisation for vascular complications of T2D remains significant and treatment inertia is a major challenge, increasing the risk of future complications.

Expanding access to new treatments, including CGM, could reduce treatment inertia and improve clinical outcomes for the T2DM population

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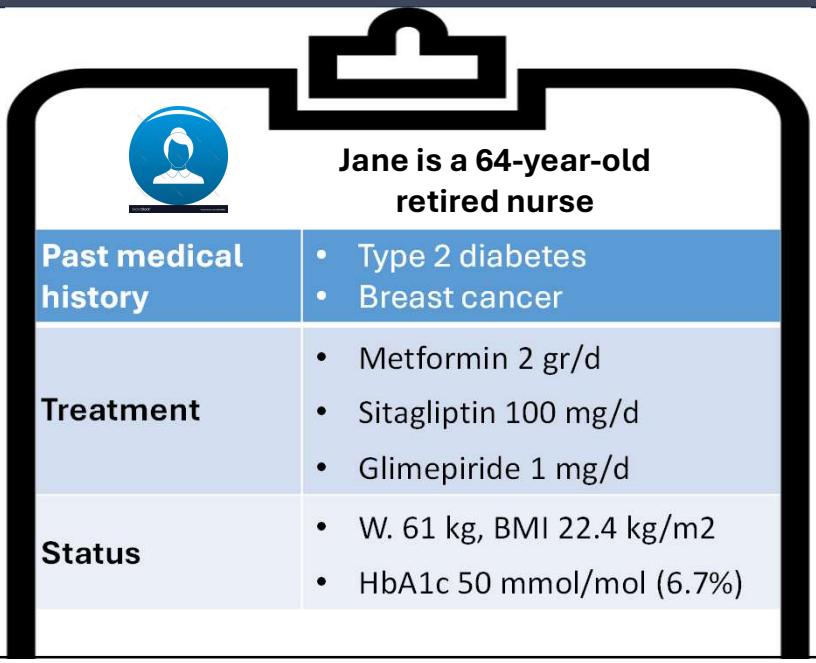
Clinical Case #6 - Diabetes and Difficult Co-Morbidities

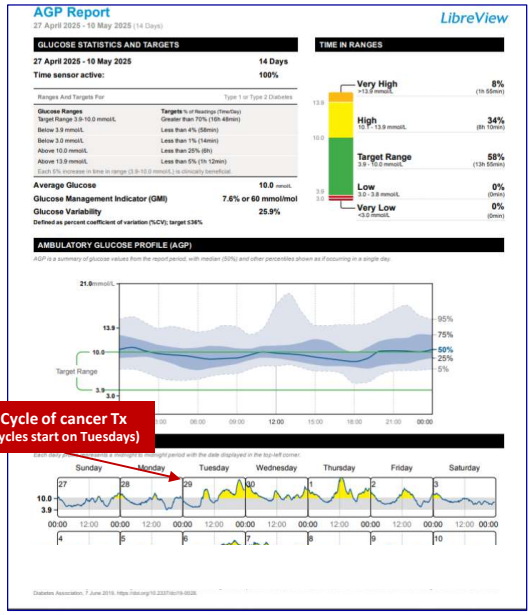


Problem

Finds it very difficult with each chemo cycle (Tuesdays; includes dexamethasone for the day) as glucose levels increase and she gets osmotic symptoms for 3 days

98

Clinical Case #6 - Diabetes and Difficult Co-Morbidities



Options:

1) Explain this is to be expected it is fine as lasts only 3 days.
2) Simply ↑dose of glimepiride.
3) ↑dose of glimepiride for 3 days.
4) Add in insulin for 3 days.
5) Start SGLT2i to protect from heart failure.

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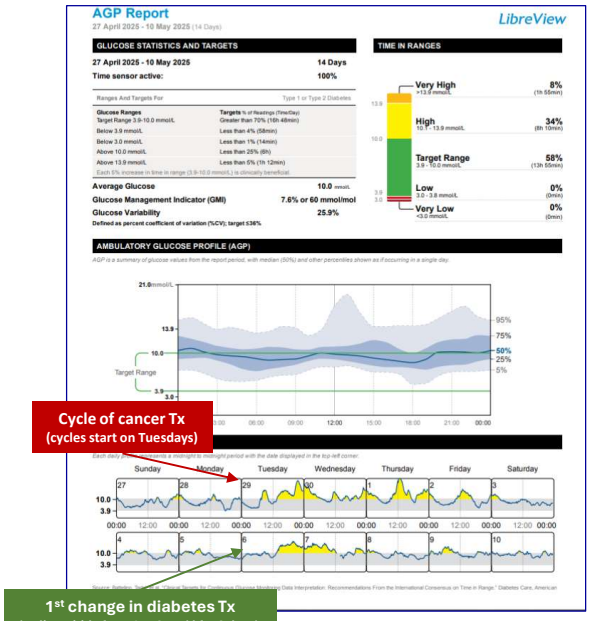
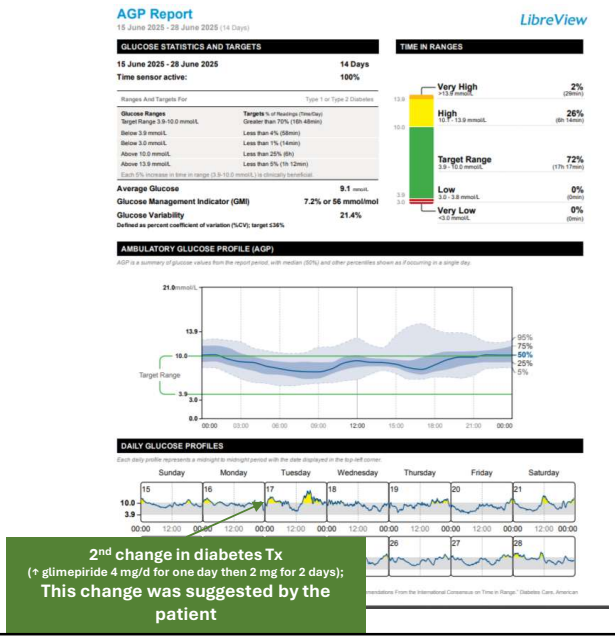
Case 6 - Diabetes and Difficult Co-Morbidities





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Conclusions

- CGM helps to engage individuals with diabetes and informs early on success/failure of a particular management strategy.

- Specifically, CGM can help with glycaemic management through:
  - Lifestyle modification
  - Keeps individual informed of the effects of daily life activities
  - Likely to assist in adherence to therapy

CGM increases patient engagement with diabetes management

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Post-Program Assessment Question #1

Based on the educational content, analyses, and case-based CGM Experts' Clinic presented in this symposium, I believe it is reasonable and appropriate for clinicians to **initiate CGM** in the following percentage of new persons with T2D who present to me and who are NOT taking insulin (i.e. persons managing diabetes with lifestyle modification or oral medications only)

1) 20–30%
2) 30-40%
3) 40–50%
4) 50–60%
5) >60%

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Post-Program Assessment Question #2

CGM is a foundational management strategy in all of the following settings: (1) Overcoming treatment inertia, (2) Modulating patient lifestyle behaviors and decisions, and (3) Adjusting pharmacologic interventions to optimize HbA1c.

1) Strongly agree
2) Agree
3) Agree in some situations
4) Disagree
5) Strongly disagree

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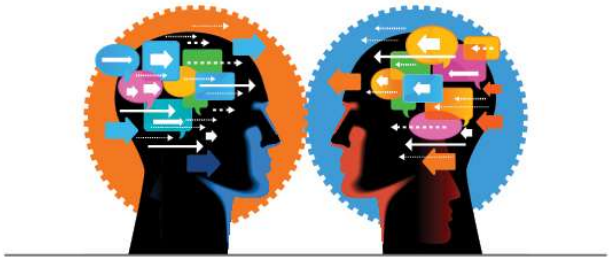
"INTERACTIVE DIALOGUE SESSION"



Your Questions, Perspectives, and Discussion Points

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