Tecnologie: tra algoritmi e linee guida

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PreVen ENDO

La Prof. Maria Ida Maiorino dichiara di aver ricevuto negli ultimi due anni compensi o finanziamenti dalle seguenti Aziende Farmaceutiche e/o Diagnostiche:

- Sanofi
- Eli Lilly

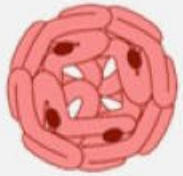
Dichiara altresì il proprio impegno ad astenersi, nell'ambito dell'evento, dal nominare, in qualsivoglia modo o forma, aziende farmaceutiche e/o denominazione commerciale e di non fare pubblicità di qualsiasi tipo relativamente a specifici prodotti di interesse sanitario (farmaci, strumenti, dispositivi medico-chirurgici, ecc.).

Evolution of glucose monitoring and insulin delivery

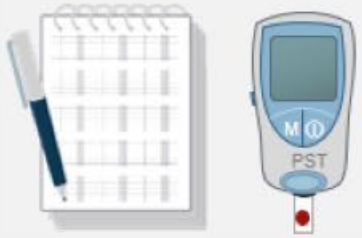
Glucose Monitoring[a]

40-50 years

HbA1c

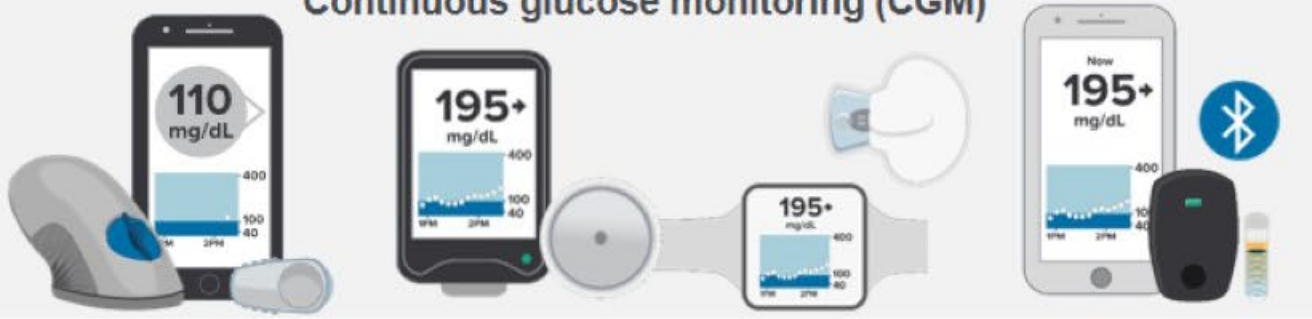


Fingerstick glucose testing



15-20 years

Continuous glucose monitoring (CGM)



Insulin Delivery[b]

100 years

Current delivery methods

- Discovery of insulin
- Insulin syringe
- Animal insulin
- Regular and NPH insulin
- Human insulin
- Insulin pen
- Insulin pump
- Analog insulin
  Basal & bolus
  1st Gen, 2nd Gen
- Automated Insulin Delivery (AID)

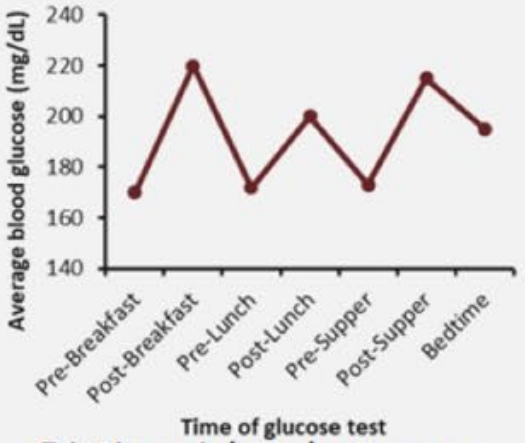
AID, automated insulin delivery; CGM, continuous glucose monitoring; NPH, Neutral Protamine Hagedorn.

a. Unger J. Am J Manag Care. 2022;28(4 suppl):S60-S68; b. Kesavadev J, et al. Diabetes Ther. 2020;11:1251-1269.; c. Boughton CK and Hovorka R. Diabetologia. 2021;64:1007-1015.

Continuous Glucose Monitoring

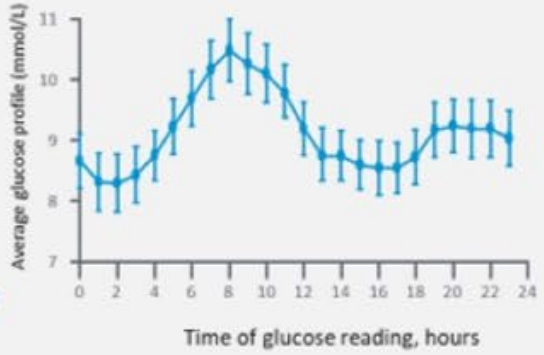
From 7-point SMBG to Ambulatory Glucose Profile

7-Point SMBG



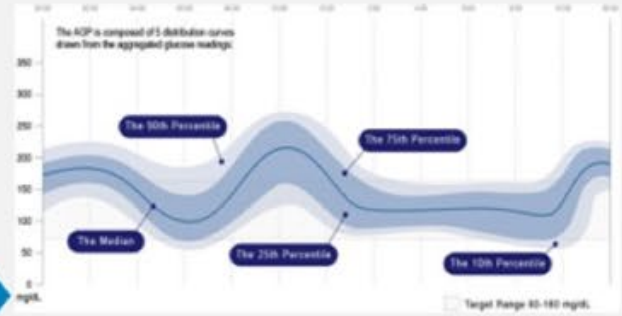
Distinguishes between **fasting, pre-prandial,** and **postprandial glucose excursions**, but only provides a snapshot[a]

Typical CGM Profile



Provides information on **direction, magnitude,** and **frequency of fluctuations** in blood glucose over 24 hours[b]

Ambulatory Glucose Profile



Average of CGM profiles to generate a **modal day** single curve, which can help in **identifying trends**[c] and visually represent **glycemic patterns**[d]

a. Parkin CG, et al. *J Diabetes Sci Technol.* 2009;3:500-508; b. De Block C, et al. *J Diabetes Sci Technol.* 2008;2:718-727; c. Hammond P. *Br J Diabetes.* 2016;16:S10-S15; d. Bergenstal RM, et al. *J Diabetes Sci Technol.* 2013;7:562-578.

Lancet Diabetes Endocrinol 2023; 11: 42–57

	Measures	Aim
Percentage of sensor data obtained	The proportion of possible obtained readings by the CGM device; provides a measure of confidence in the all data-derived metrics	≥70% of data during the collection period
Frequency of scanning (eg, scans per day)	For FreeStyle Libre and FreeStyle Libre 2 systems, the sensor should be scanned periodically with a reader or the smartphone app; the frequency of scanning is associated with changes in glucose metrics[64]	Frequency of minimum once every 8 h to ensure no gaps in data
Time in ranges		
Time in range	Measures the percentage of time spent in consensus target glucose range 70–180 mg/dL (3·9–10·0 mmol/L); during pregnancy, this range is 63–140 mg/dL (3·5–7·8 mmol/L).	>70% of time per day (ie, 16 h 48 min) in type 1 and type 2 diabetes; >50% of time per day (12 h) in people older than 60 years or patients at high risk
Time in tight range	A secondary measure of time in range, measures the percentage of time spent in target glucose range 70–140 mg/dL (3·9–7·8 mmol/L)	Suggested time in tight range aim is >70% of each day[47]
Time below range (<70 mg/dL [<3·9 mmol/L])	Measures the percentage of time spent with glucose <70 mg/dL (<3·9 mmol/L), including readings <54 mg/dL (<3·0 mmol/L)	<4% of time per day (1 h) in type 1 and type 2 diabetes; <1% of time per day (15 min) in people older than 60 years or patients at high risk
Time below range (low glucose or Level 1 hypoglycaemia)	Measures the percentage of time spent with glucose 54–69 mg/dL (3·0–3·9 mmol/L); Level 1 hypoglycaemia is an alert threshold	No international consensus recommendations
Time below range (very low glucose or Level 2 hypoglycaemia)	Measures the percentage of time spent with glucose <54 mg/dL (<3·0 mmol/L); Level 2 hypoglycaemia is considered clinically significant and requiring immediate attention	<1% of time per day (15 min) in type 1 and type 2 diabetes
Time above range (>180 mg/dL [>10·0 mmol/L])	Measures the percentage of time spent with >180 mg/dL (>10·0 mmol/L), including readings >250 mg/dL (>13·9 mmol/L)	<25% of time per day (6 h) in type 1 and type 2 diabetes; <10% of time per day (2 h 24 min) in people older than 60 years or patients at high risk
Time above range (high glucose or Level 1 hyperglycaemia)	Measures the percentage of time spent with glucose 181–250 mg/dL (10·1–13·9 mmol/L)	No international consensus recommendations
Time above range (very high glucose or Level 2 hyperglycaemia)	Measures the percentage of time spent with glucose >250 mg/dL (>13·9 mmol/L)	<5% of time per day (1 h 12 min) in type 1 and type 2 diabetes
Mean sensor glucose	A measure of the mean 24 h glucose concentration calculated across all recorded glucose readings	No international consensus recommendations
Glucose Management Indicator	A measure of short-term glucose levels that can be used to predict long-term glucose exposure; the Glucose Management Indicator is expressed in the same units as HbA_{1c} (eg, as a percentage or mmol/mol) for comparative purposes, but they are usually not identical	No international consensus recommendations
Glycemia Risk Index	A single-number summary of the quality of glycaemia; ranks the quality of glucose control, allocating increased weight to very low and very high glucose; the Glycemia Risk Index can also be displayed graphically on a Glycaemia Risk Index grid	No international consensus recommendations
Coefficient of variation	A measure of dynamic glucose variability expressed as percentage coefficient of variation and calculated as 100 × (SD divided by mean glucose); coefficient of variation is correlated with time below range	≤36% of glucose variability in type 1 diabetes
SD of mean glucose	The SD of mean glucose values is a measure of dynamic glucose variability; SD is strongly correlated with mean glucose	No international consensus recommendations

Each of these measures of glucose control can be derived and reported by CGM devices. They are all endorsed by international consensus guidance on the use of CGM devices in the management of diabetes.[4–6]

Table 2: **Objective measures of glycaemic control derived from CGM devices**

Effects of Continuous Glucose Monitoring on Metrics of Glycemic Control in Diabetes: A Systematic Review With Meta-analysis of Randomized Controlled Trials

Diabetes Care 2020;43:1146–1156 | https://doi.org/10.2337/dc19-1459

Maria Ida Maiorino,[1,2] Simona Signoriello,[3] Antonietta Maio,[2] Paolo Chiodini,[3] Giuseppe Bellastella,[1,2] Lorenzo Scappaticcio,[1,2] Miriam Longo,[2] Dario Giugliano,[1,2] and Katherine Esposito[2,4]

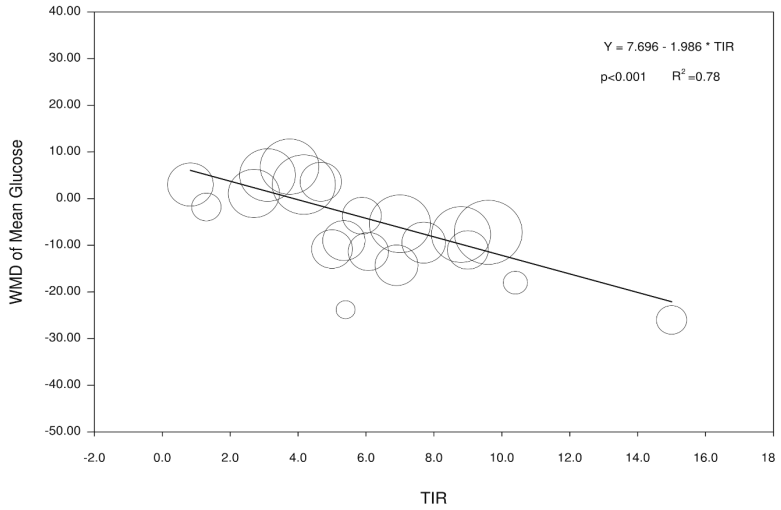
Table 2—Preplanned subgroup analysis

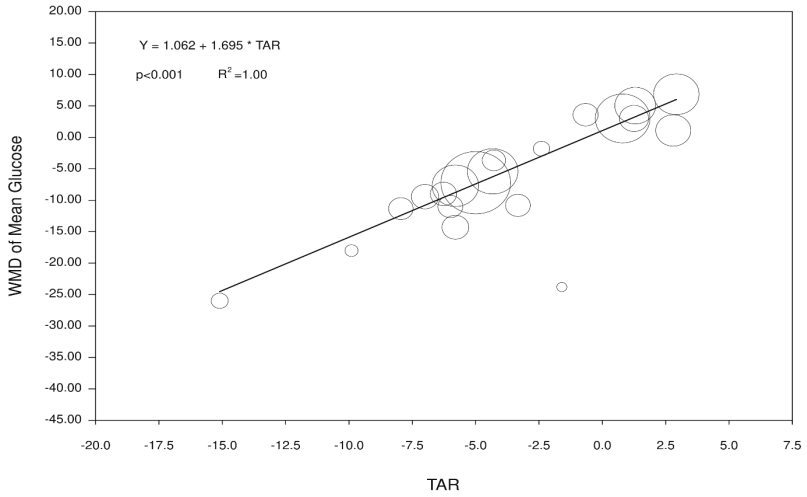
	Comparisons	Patients	Control subjects	Estimated WMD (95% CI)	*P*	I^2	*P* value of Q test
HbA_{1c}							
rtCGM	13	851	769	−0.23 (−0.36 to −0.10)	<0.001	92.2%	<0.001
iCGM	3	350	276	0.00 (−0.01 to 0.02)	0.861	0.0%	0.934
SAP	2	107	108	−0.16 (−0.67 to 0.35)	0.542	85.5%	0.009
Overall	18	1,308	1,153	−0.17 (−0.29 to −0.06)	0.003	96.2%	<0.001
TIR							
rtCGM	13	851	769	83.49 (52.68–114.30)	<0.001	66.5%	<0.001
iCGM	3	350	276	53.91 (28.54–79.27)	<0.001	0.0%	0.617
SAP	2	107	108	37.10 (0.74–73.45)	0.045	0.0%	0.799
Overall	18	1,308	1,153	70.74 (46.73–94.76)	<0.001	66.3%	<0.001
TBR level 1							
rtCGM	13	851	769	−15.82 (−25.70 to −5.95)	0.002	96.6%	<0.001
iCGM	3	350	276	−56.26 (−88.91 to −23.60)	0.001	93.7%	<0.001
SAP	2	107	108	−41.04 (−127.10 to 45.02)	0.350	88.1%	0.004
Overall	18	1,308	1,153	−27.16 (−42.08 to −12.25)	<0.001	98.9%	<0.001
TBR level 2							
rtCGM	8	524	450	−5.65 (−10.83 to −0.46)	0.033	74.3%	<0.001
iCGM	3	350	276	−26.23 (−49.07 to −3.40)	0.024	86.8%	0.001
SAP	1	76	77	−37.40 (−46.05 to −28.75)	<0.001	—	—
Overall	12	950	803	−13.58 (−20.63 to −6.53)	<0.001	91.7%	<0.001
TAR level 1							
rtCGM	12	788	716	−54.34 (−75.03 to −33.64)	<0.001	21.7%	0.230
iCGM	2	231	156	35.52 (−3.00 to 74.03)	0.071	0.0%	0.588
SAP	2	107	108	23.98 (−34.95 to 82.90)	0.425	26.3%	0.244
Overall	16	1,126	980	−30.26 (−58.15 to −2.38)	0.033	67.9%	<0.001
TAR level 2							
rtCGM	8	545	462	−44.79 (−74.97 to −14.61)	0.004	69.6%	0.002
iCGM	3	350	276	−16.16 (−30.57 to −1.74)	0.028	0.0%	0.562
SAP	1	76	77	−1.44 (−28.09 to 25.21)	0.916	—	—
Overall	12	971	815	−27.68 (−45.31 to −9.97)	0.004	63.9%	0.002
CV							
rtCGM	7	509	449	−2.56 (−5.28 to 0.17)	0.066	93.1%	<0.001
iCGM	3	350	276	−3.86 (−5.15 to −2.57)	<0.001	78.1%	0.010
SAP	—	—	—	—	—	—	—
Overall	10	859	725	−3.09 (−4.43 to −1.74)	<0.001	90.7%	<0.001

The therapeutic efficacy of CGM in diabetes: a meta-analysis with meta-regression

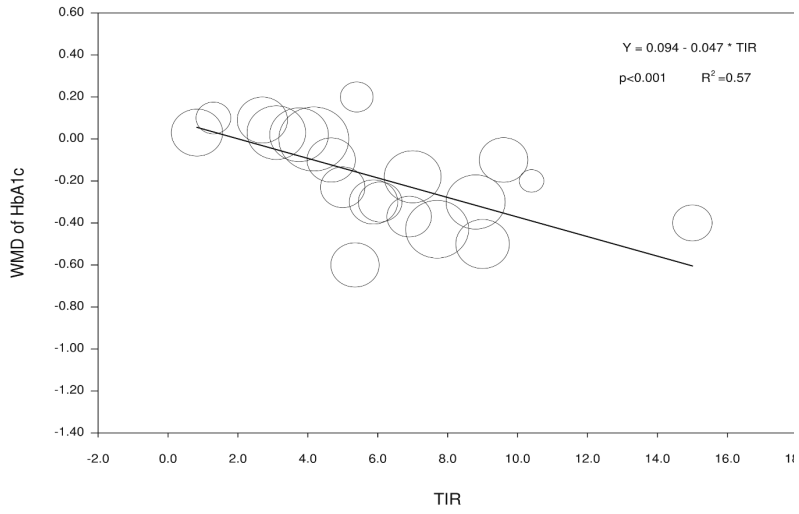
P: subjects with both type 1 and type 2 diabetes and pregnant women with diabetes.
I: CGM as either rtCGM, iCGM or SAP, compared with usual care (mainly self blood glucose monitoring).
C: age-matched subjects with type 1 or type 2 diabetes.
O: change in HbA1c, mean glucose and CGM-derived metrics (including TIR, TAR, TBR)

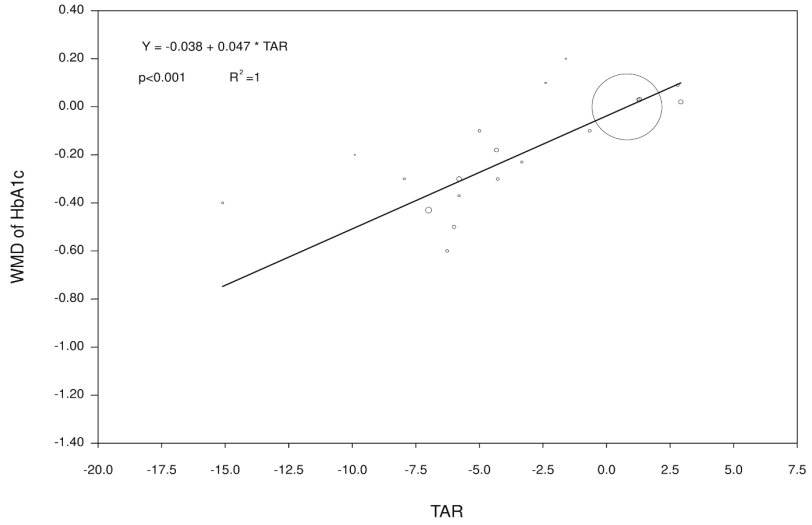
19 RCTs, 20 comparisons and 2949 patients





Variable	β Coefficient	P value	R^2 (%)
TIR	-1.98	0.000	78
TBR	-0.90	0.095	21
TAR	1.69	0.000	100



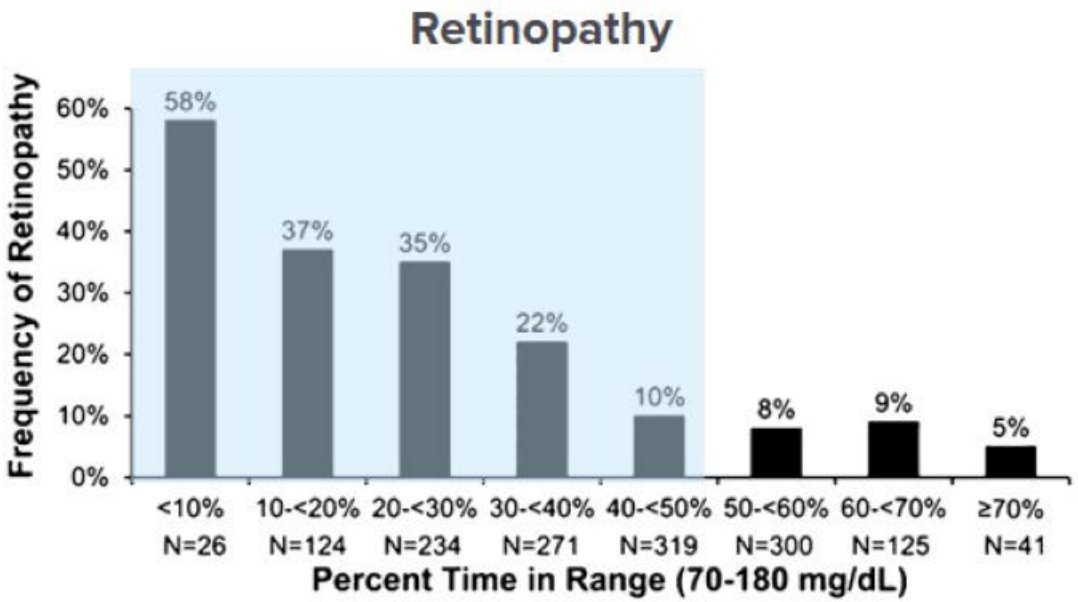


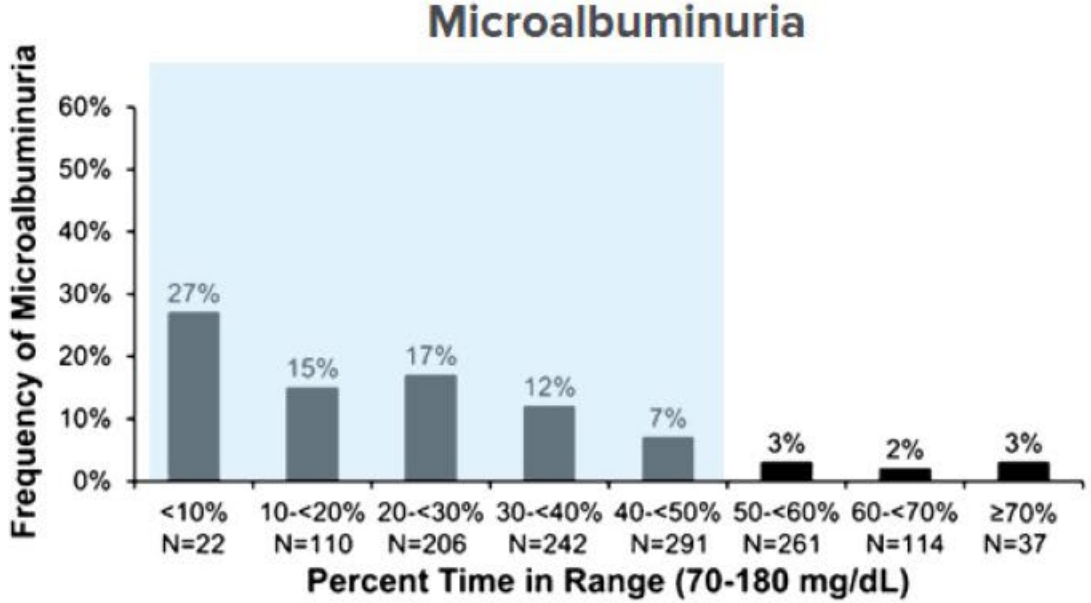
Variable	β Coefficient	P value	R^2 (%)
TIR	-0.046	0.000	57
TBR	-0.014	0.371	0
TAR	0.047	0.000	100

Maiorino MI et al. 2024

Is Time in Range a risk factor?

TIR ≤ 50% confers greater risk of complications in patients with T1D or T2D





TIR	*N*	*N* (%) with outcome	Unadjusted HR (95% CI)*	Adjusted HR (95% CI)†	*N*	*N* (%) with outcome	Unadjusted HR (95% CI)*	Adjusted HR (95% CI)†
Overall								
≥50%	466	36 (8)	1.00	1.00	412	10 (2)	1.00	1.00
40 to <50%	319	32 (10)	1.54 (0.94–2.55)	1.61 (0.97–2.65)	291	20 (7)	2.44 (1.05–5.67)	2.40 (1.03–5.58)
30 to <40%	271	59 (22)	3.38 (2.22–5.15)	3.37 (2.20–5.15)	242	29 (12)	4.74 (2.16–10.40)	4.39 (2.01–9.58)
<30%	384	144 (38)	6.23 (4.25–9.13)	6.93 (4.69–10.24)	338	57 (17)	6.68 (3.35–13.29)	6.98 (3.49–13.96)

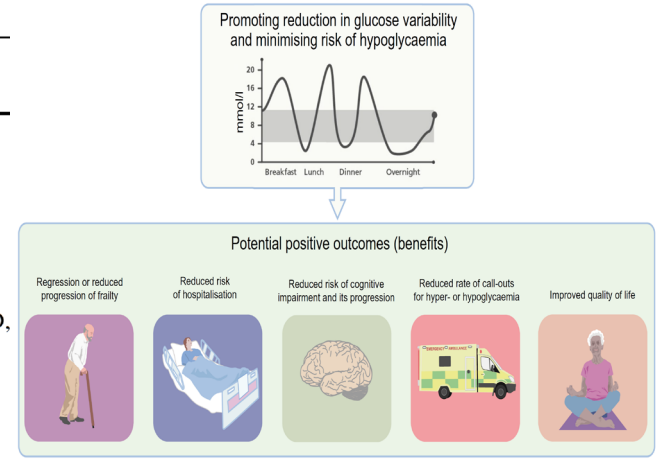
Beck RW, et al. Diabetes Care. 2019;42:400-405.

Table 1 Key studies exploring the relationship between glucose variability and adverse events in older people with diabetes

Study	Objectives	Method used to assess GV	Type of diabetes	Sample size	Age (years)[a]	Main findings
Single-centre study, Toschi et al 2020 [24]	Evaluate relationship between GV and risk of hypoglycaemia	CGM	T1D	130	71 ± 5	Participants with high GV (>36% CV) spent more time in hypoglycaemia (<3.9 mmol/l and <3.0 mmol/l) than those with low GV (≤36% CV; 84 min/day vs 31 min/day, $p<0.0001$, and 46 min/day vs 8 min/day, $p<0.001$, respectively)
Population-based retrospective cohort study, Li et al 2017 [26]	Evaluate relationship between visit-to-visit variations in FPG and HbA_{1c} and AD	Variations in FPG and HbA_{1c} represented by the CV	T2D	16,706	69 ± 5.9	FPG CV and HbA_{1c} CV were predictors of AD, with HRs of 1.27 (95% CI 1.06, 1.52) for the third tertile in FPG CV and 1.32 (95% CI 1.11, 1.58) for the third tertile in HbA_{1c} CV
Observational study, Chung et al 2021 [27]	Investigate relationship between GV and frailty	CGM	T2D	48	Healthy/pre-frail: 78.5 ± 7.4; frail: 80.8 ± 6.5	No statistically significant differences in TIR (60.0% vs 44.2%, $p=0.053$), TAR (39.2% vs 55.0%, $p=0.053$), % CV and TBR ($p>0.1$) between healthy/pre-frail and frail individuals. CGM metrics (GMI-HbA_{1c}, TAR) were higher in the frail group only in the postprandial periods (all $p<0.05$)
Multicentre, prospective, observational cohort study, Fung et al 2021 [28]	Investigate relationship between frailty, dysglycaemia and mortality risk	CGM	T2D	215	Median (IQR) 74 (71–78)	Decreased TIR and increased TAR metrics were strongly correlated with increased frailty and hyperglycaemia ($p<0.00001$), whereas TBR metrics (<3.9 and 3.0–3.8 mmol/l) were marginally ($p<0.05$) or not different (<3.0 mmol/l, $p=0.18$) between frailty levels
Data analysis from three prospective studies, Idrees et al 2023 [29]	Investigate effects of frailty on glucose control among hospitalised individuals	CGM	T2D	263	103 aged ≥60 years; 160 aged <60 years	Higher degree of frailty was associated with higher % CGM <3.9 mmol/l and <3.0 mmol/l
Retrospective cohort study, Forbes et al 2018 [30]	Investigate association between HbA_{1c} variability over time and mortality risk	Score based on HbA_{1c} variability over time	T1D and T2D	54,803	Women: 79 ± 6.1; men: 77.5 ± 5.4	Survival rate was inversely associated with GV
Observational study, Ma et al 2023 [31]	Explore relationship between blood glucose fluctuations and sarcopenia	CGM	T2D	280 (sarcopenic: $n=43$; non-sarcopenic: $n=237$)	≥60	Prevalence of sarcopenia was inversely associated with TIR values (40.48% for TIR≤50%, 20.41% for 50%<TIR≤70%, 8.47% for TIR>70%). No difference in GV parameters (CV, MAGE) between the two groups (CV: $p=0.872$; MAGE: $p=0.366$)
Observational study, Zhang et al 2021 [32]	Investigate effect of GV on risk of arrythmias in older and middle-aged people	CGM	T2D	107 (older: $n=73$; middle-aged: $n=34$)	Older: 81.1 ± 5.3; middle-aged: 56.7 ± 5.2	Older people had greater GV ($p<0.05$) and were more prone to supraventricular and ventricular arrhythmias than younger individuals ($p<0.005$)

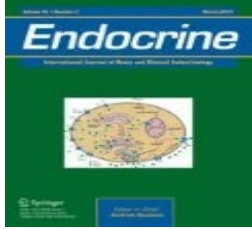
[a]Data are mean ± SD unless indicated otherwise

AD, Alzheimer's disease; CGM, continuous glucose monitoring; FPG, fasting plasma glucose; GMI, glucose management indicator; GV, glucose variability; MAGE, mean amplitude of glycaemic excursions; T1D, type 1 diabetes; T2D, type 2 diabetes; TAR, time above range; TBR, time below range; TIR, time in range



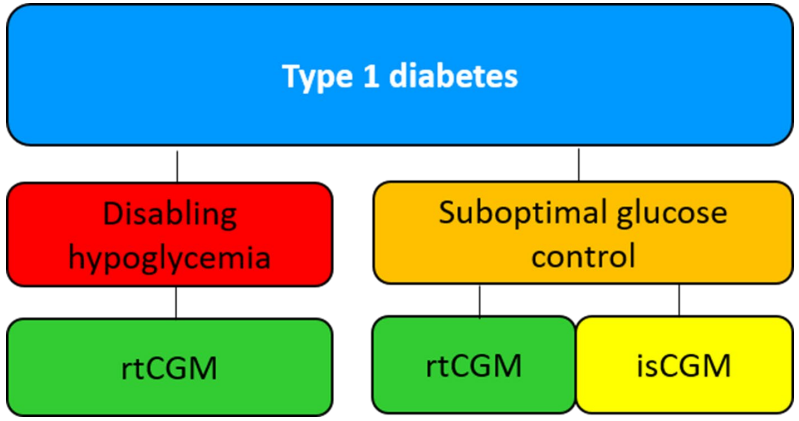
REVIEW

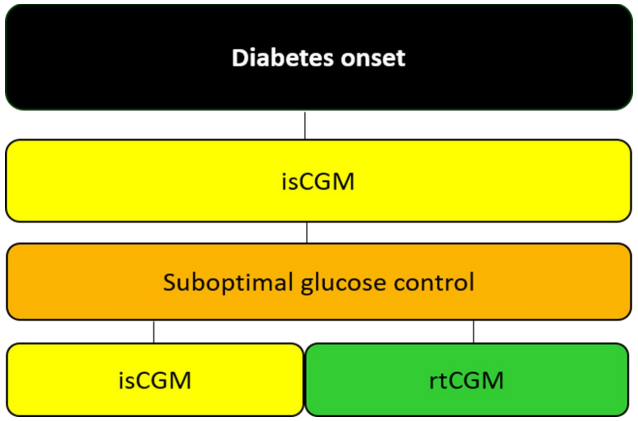
Endocrine. 2023;82(2):215-225

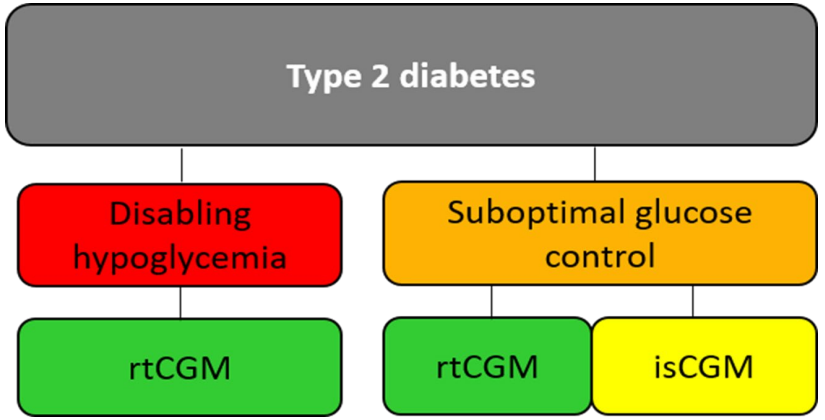


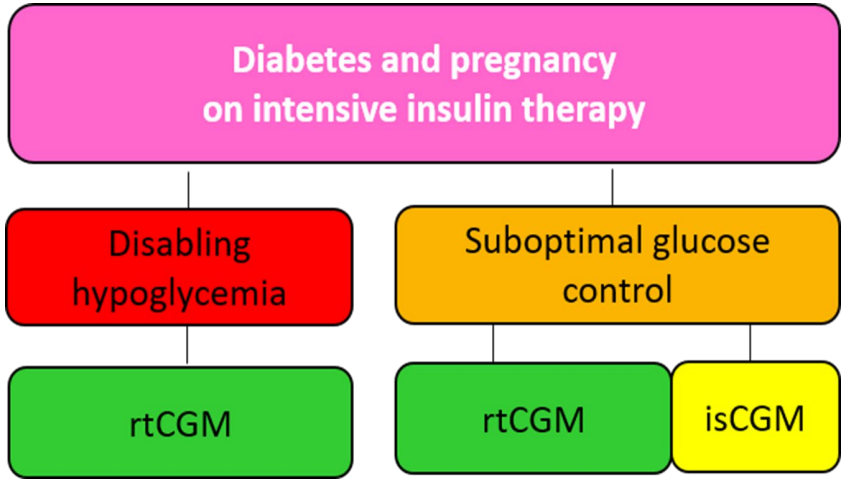
An updated algorithm for an effective choice of continuous glucose monitoring for people with insulin-treated diabetes

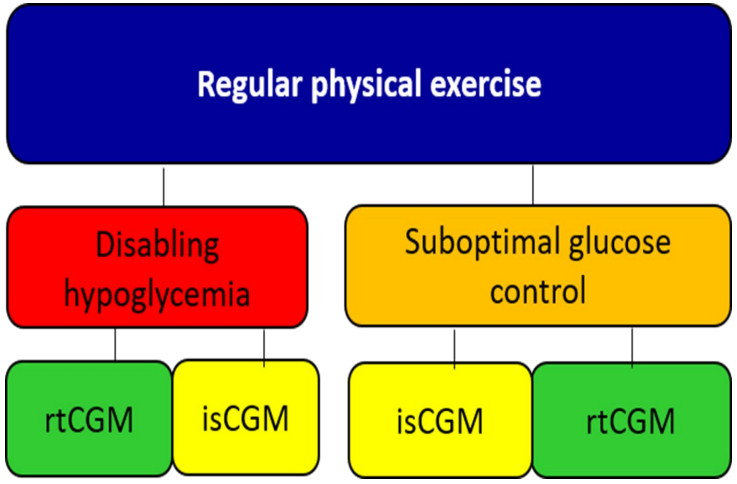
Maria Ida Maiorino[1,2] · Raffaella Buzzetti[3] · Concetta Irace[4] · Luigi Laviola[5] · Nicola Napoli[6] · Dario Pitocco[7] · Katherine Esposito[1,2] · on behalf of LIVE CGM working group

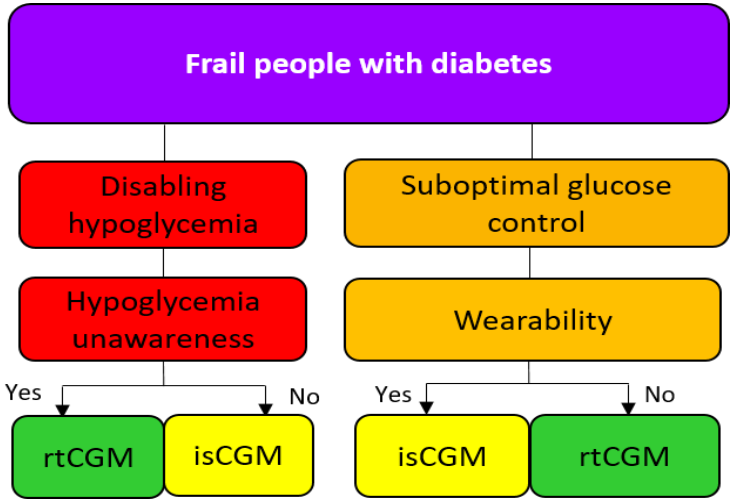












Initiation of Continuous Glucose Monitoring Is Linked to Improved Glycemic Control and Fewer Clinical Events in Type 1 and Type 2 Diabetes in the Veterans Health Administration

	CGM Initiation vs Self-Monitoring Glucose	
	Type 1 Diabetes	Type 2 Diabetes
12-Month Change in HbA1c	n = 4930 vs n = 3263	n = 15,292 vs n = 28,467
CGM use leads to more reduction in 12-month HbA1c		
β (95% CI):	-0.26 (-0.33, -0.19) ⬇	-0.35 (-0.42, -0.36) ⬇
Clinical Events Over 12 Months	n = 5015 vs n = 3815	n = 15,706 vs n = 29,912
I. Hypoglycemia admissions	CGM use leads to reduced hypoglycemia admissions in T1D	
HR (95% CI):	0.69 (0.48, 0.98) ⬇	0.93 (0.74, 1.16)
II. Hyperglycemia admissions	CGM use leads to reduced hyperglycemia admissions in T2D	
HR (95% CI):	0.83 (0.65, 1.06)	0.87 (0.77, 0.99) ⬇
III. All hospitalizations	CGM use leads to reduced hospitalizations	
HR (95% CI):	0.75 (0.63, 0.93) ⬇	0.89 (0.82, 0.87) ⬇

HbA1c, glycated hemoglobin; T1D, type 1 diabetes; T2D, type 2 diabetes.

Reaven PD, et al. Diabetes Care. 2023;46:854-863.

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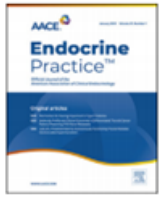


AACE Guideline

American Association of Clinical Endocrinology Clinical Practice Guideline: The Use of Advanced Technology in the Management of Persons With Diabetes Mellitus

George Grunberger, MD, FACP, MACE, Co-Chair [1], Jennifer Sherr, MD, PhD, Co-Chair [2], Myriam Allende, MD, FACE, FACP [3], Thomas Blevins, MD, FACE, ECNU [4], Bruce Bode, MD, FACE [5], Yehuda Handelsman, MD, FACP, FNLA, FASPC, MACE [6], Richard Hellman, MD, FACE, FACP [7], Rosemarie Lajara, MD [8], Victor Lawrence Roberts, MD, MBA, FACP, FACE, ECNU [9], David Rodbard, MD [10], Carla Stec, MA [11], Jeff Unger, MD, FAAFP, FACE [12]

Recommendation 2.1.1

CGM is strongly recommended for all persons with diabetes treated with intensive insulin therapy, defined as 3 or more injections of insulin per day or the use of an insulin pump.

Grade A; High Strength of Evidence; BEL 1

Recommendation 2.1.3

CGM is recommended for all individuals with problematic hypoglycemia (frequent/severe hypoglycemia, nocturnal hypoglycemia, hypoglycemia unawareness).

Grade A; Intermediate-High Strength of Evidence; BEL 1

Question 2:
Who would benefit from diabetes technologies?

Glucose Monitoring Technologies

Q2.1 Who would benefit from routine use of continuous glucose monitoring?

Recommendation 2.1.4

CGM is recommended for children/adolescents with T1D.

Grade A; Intermediate-High Strength of Evidence; BEL 1

Recommendation 2.1.5

CGM is recommended for pregnant women with T1D and T2D treated with intensive insulin therapy.

Grade A; Intermediate-High Strength of Evidence; BEL 1

Recommendation 2.1.6

CGM is recommended for women with GDM on insulin therapy.

Grade A; Intermediate Strength of Evidence; BEL 1

Recommendation 2.1.7

CGM may be recommended for women with GDM who are not on insulin therapy.

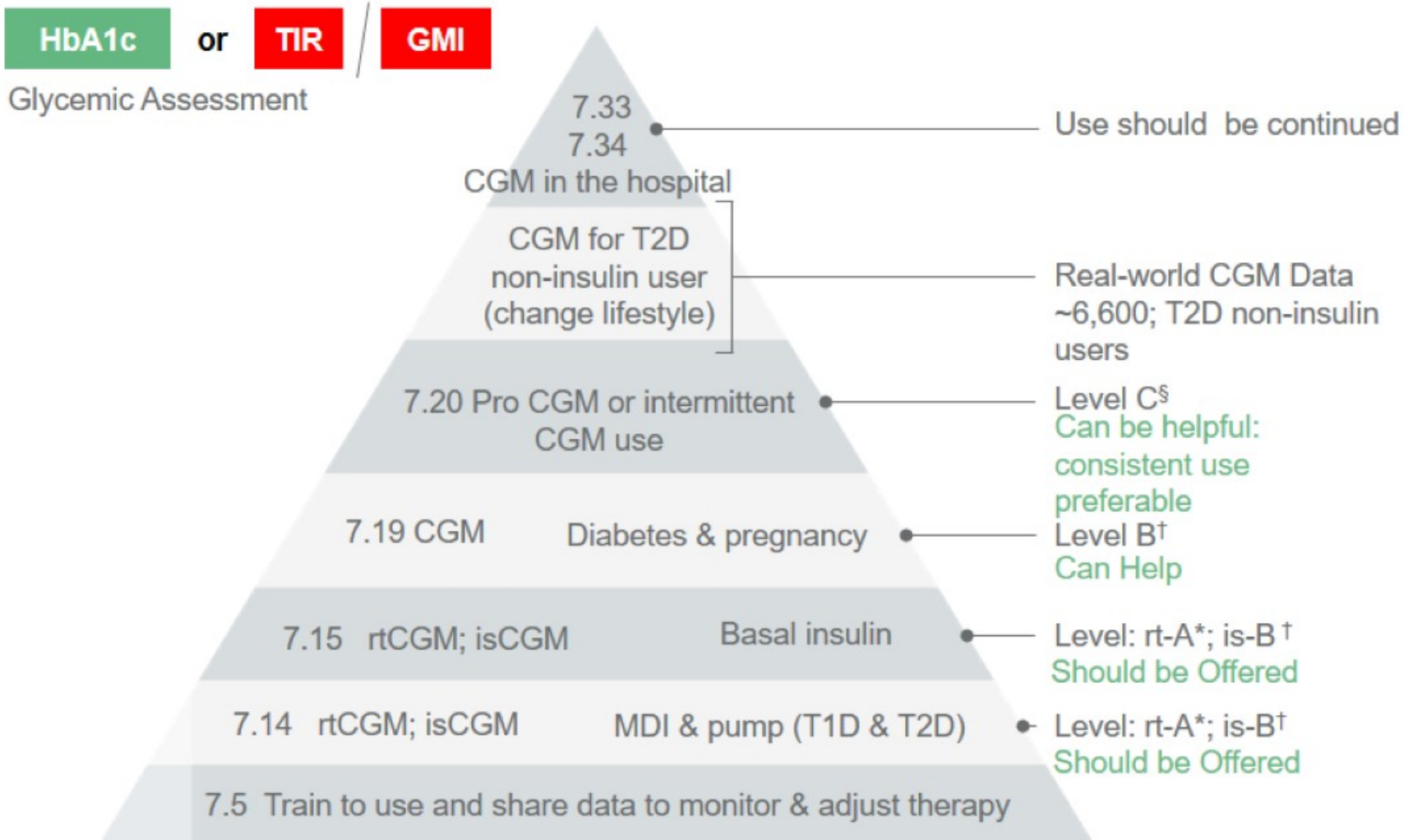
Grade B; Intermediate Strength of Evidence; BEL 1

Recommendation 2.1.8

CGM may be recommended for individuals with T2D who are treated with less intensive insulin therapy.

Grade B; Intermediate Strength of Evidence; BEL 1

ADA 2024: Recommendations for CGM Use in Glycemic Management



A1c, glycated hemoglobin; DM, diabetes mellitus; isCGM, intermittently scanned CGM; MDI, multiple daily injections; pro CGM, professional CGM.
American Diabetes Association Professional Practice Committee. Diabetes Care. 2024;47(suppl 1):S126-S144.

Diabete Tipo 1

Linea Guida della Associazione dei Medici Diabetologi (AMD), della Società Italiana di Diabetologia (SID) e della Società Italiana di Endocrinologia e Diabetologia Pediatrica (SIEDP)

La terapia del diabete mellito di tipo 1

GRADO DI RACCOMANDAZIONE

Raccomandazione forte a favore dell'intervento, con qualità delle prove moderata.

In soggetti con diabete mellito di tipo 1 si raccomanda di utilizzare un sistema di monitoraggio in continuo del glucosio rispetto all'automonitoraggio glicemico capillare.

GRADO DI RACCOMANDAZIONE

Raccomandazione condizionata a favore dell'intervento, con qualità delle prove moderata.

In soggetti con diabete mellito di tipo 1 con storia di ipoglicemia severa o ipoglicemie inavvertite o con frequenti episodi di ipoglicemia si raccomanda di utilizzare sistemi di monitoraggio in continuo del glucosio dotati di avvisi predittivi rispetto a sistemi privi di avvisi predittivi.

Versione aggiornata a gennaio 2024

Diabete Tipo 2

Linea Guida della Società Italiana di Diabetologia (SID) e dell'Associazione dei Medici Diabetologi (AMD)
Obiettivi terapeutici

6. Monitoraggio glicemico

6.1 Si suggerisce un monitoraggio glicemico strutturato (con uno schema predefinito di glicemie capillari da eseguire) per i soggetti con diabete mellito di tipo 2.

Forza della raccomandazione: debole. Qualità delle prove: molto bassa.

Giustificazione

Ci sono pochi trial, di scarsa qualità e con numero esiguo di pazienti che mostrano piccoli, ma significativi, miglioramenti del controllo glicemico con il monitoraggio glicemico strutturato, rispetto ad uno non strutturato. La bassa qualità delle prove e la presenza di problemi metodologici degli studi inclusi limitano la forza della presente raccomandazione. Le risorse economiche necessarie per l'implementazione di questa raccomandazione sono trascurabili.

6.2. **Non si dà preferenza al monitoraggio glicemico in continuo o al controllo glicemico capillare per la misurazione della glicemia nei pazienti con diabete mellito di tipo 2 in trattamento insulinico basal-bolus.**

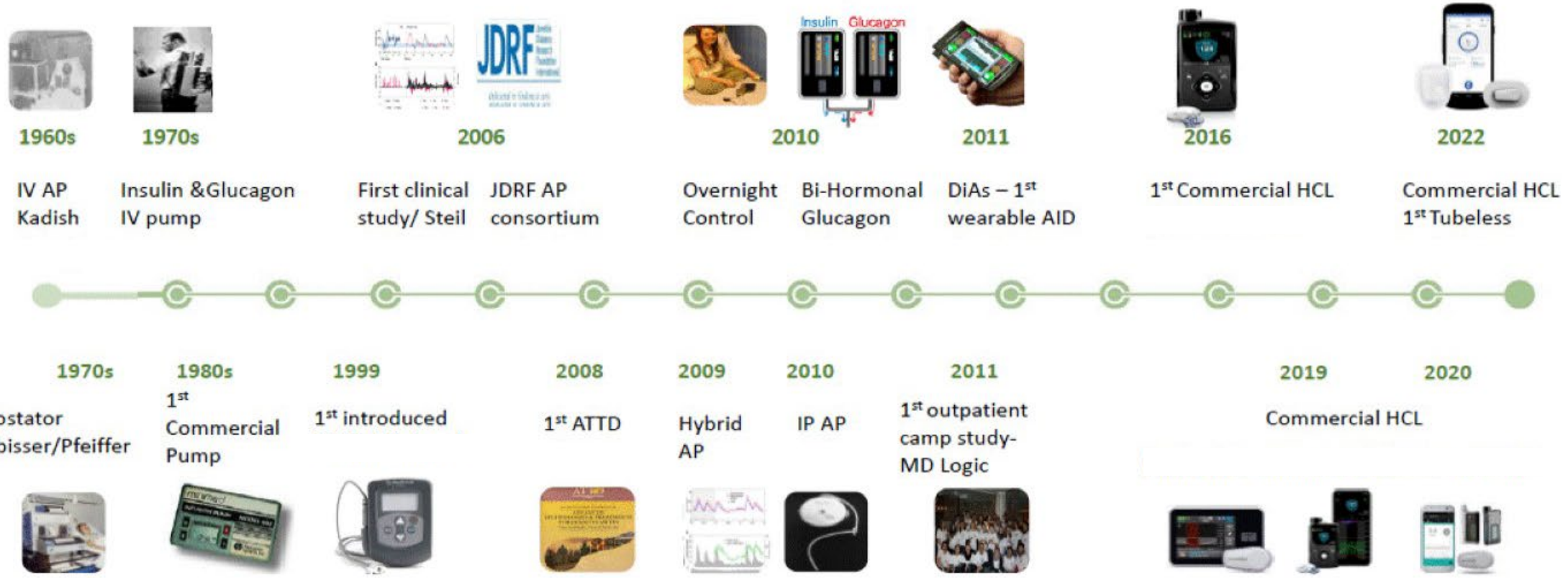
Forza della raccomandazione: debole. Qualità delle prove: molto bassa.

Giustificazione

Ci sono pochi studi e di bassa qualità che suggeriscono un piccolo miglioramento dei valori di HbA1c con il monitoraggio continuo della glicemia, senza aumento del rischio ipoglicemico; tuttavia è possibile che il monitoraggio in continuo della glicemia possa in alcuni pazienti peggiorare la qualità della vita. La costo-efficacia del monitoraggio continuo della glicemia dipende dal sistema utilizzato e dal contesto economico e deve essere ulteriormente verificata. I dati sulla preferenza dei pazienti per sistemi di monitoraggio in continuo derivano generalmente da studi osservazionali, con scarse evidenze da trial clinici. Accettabilità, equità e fattibilità potrebbero variare in contesti diversi.

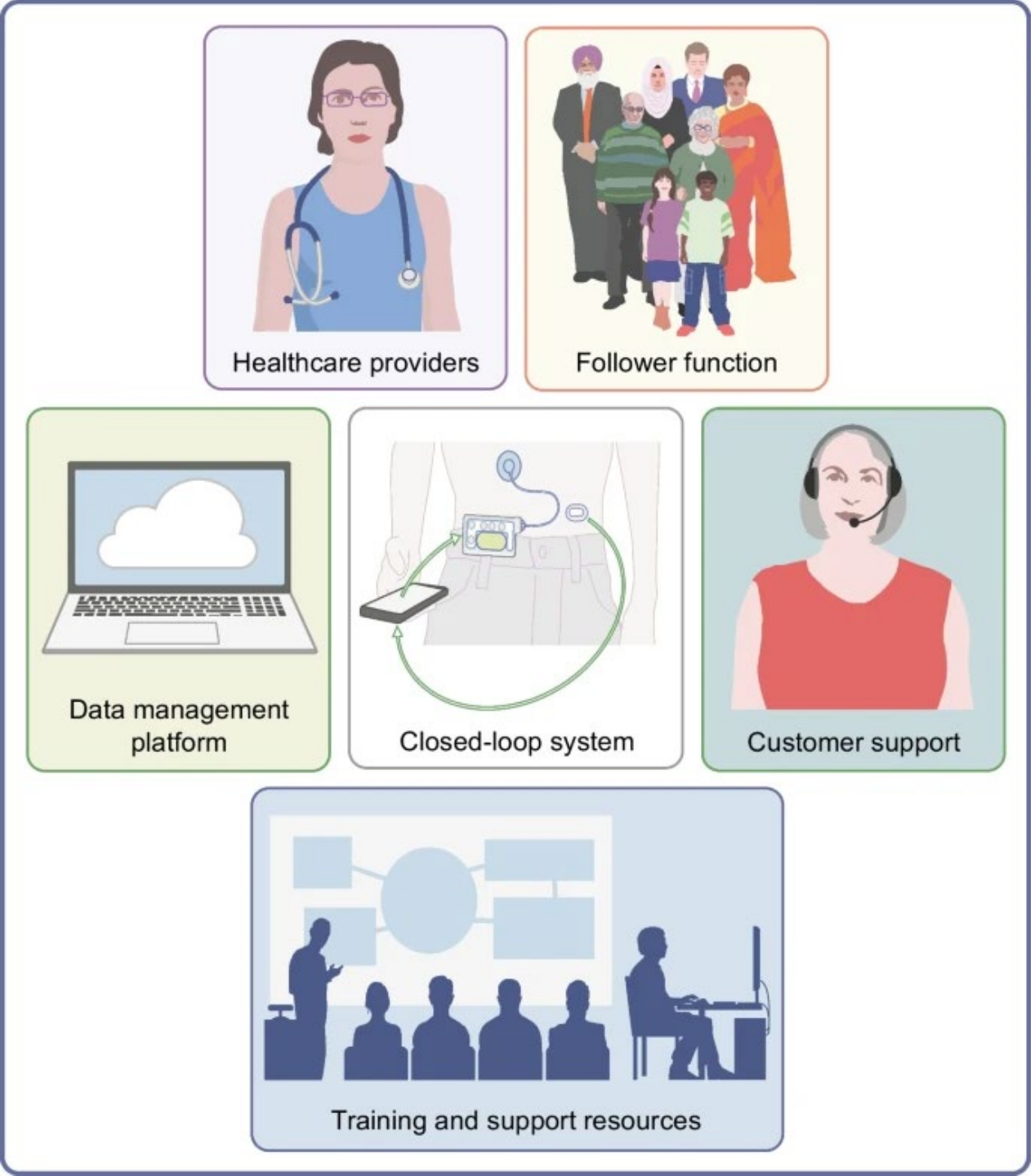
Versione aggiornata a dicembre 2022

Evolution of automated Insulin Delivery System



It is the policy of Medscape Education to avoid the mention of brand names or specific manufacturers in accredited educational activities. However, manufacturer names related to devices are provided in an effort to promote clarity for the learner.

DiAs, Diabetes Assistant; HCL, hybrid closed-loop; IP, intraductal papillary; IV, intravenous; JDRF, Juvenile Diabetes Research Foundation.



Before starting to use a closed-loop system users require training and support on the devices.
Once users are on board, data from the closed loop system is uploaded to a data management platform and can be visualised in real-time by caregivers/family members (follower function) and by healthcare providers to support optimisation of diabetes management.
In the event of device issues, users will need to contact customer support for assistance.

Diabetologia. 2024;67(10):2034-2044

Summary of clinical evidence

FDA Approved

FDA Cleared

FDA Approval Pathway

CE Approved

- Extensive RCT studies: TIR increased by 9% to 16% for most systems whereas HbA1c levels decreased by 0.3% to 0.5%, with either no change or a reduction in time in hypoglycemia
- Real-world data: support the controlled studies outcomes

It is the policy of Medscape Education to avoid the mention of brand names or specific manufacturers in accredited educational activities. However, manufacturer names related to devices are provided in an effort to promote clarity for the learner.

CE, Conformité Européenne; FDA, US Food and Drug Administration; RCT, randomized controlled trial; TIR; time in range.

ORIGINAL ARTICLE

WILEY

Diabetes Obes Metab. 2022;24:1370–1379

Comparison of [redacted] system performance in users aged younger and older than 15 years: Evidence from 12 870 real-world users

- Data from over 100,000 AHCL users across Europe, the Middle East and Africa showed that time spent in closed-loop mode was 90%, while time spent in target glucose range (70-180 mg/dL) was 72.3% with 2.0% of time spent below target range.
- That optimal glucose management is associated with applying the lowest glucose target setting (5.5 mmol/l) and the shortest active insulin time setting (2 h).

Diabetes Technol Ther. 2024;26(S3):32-3

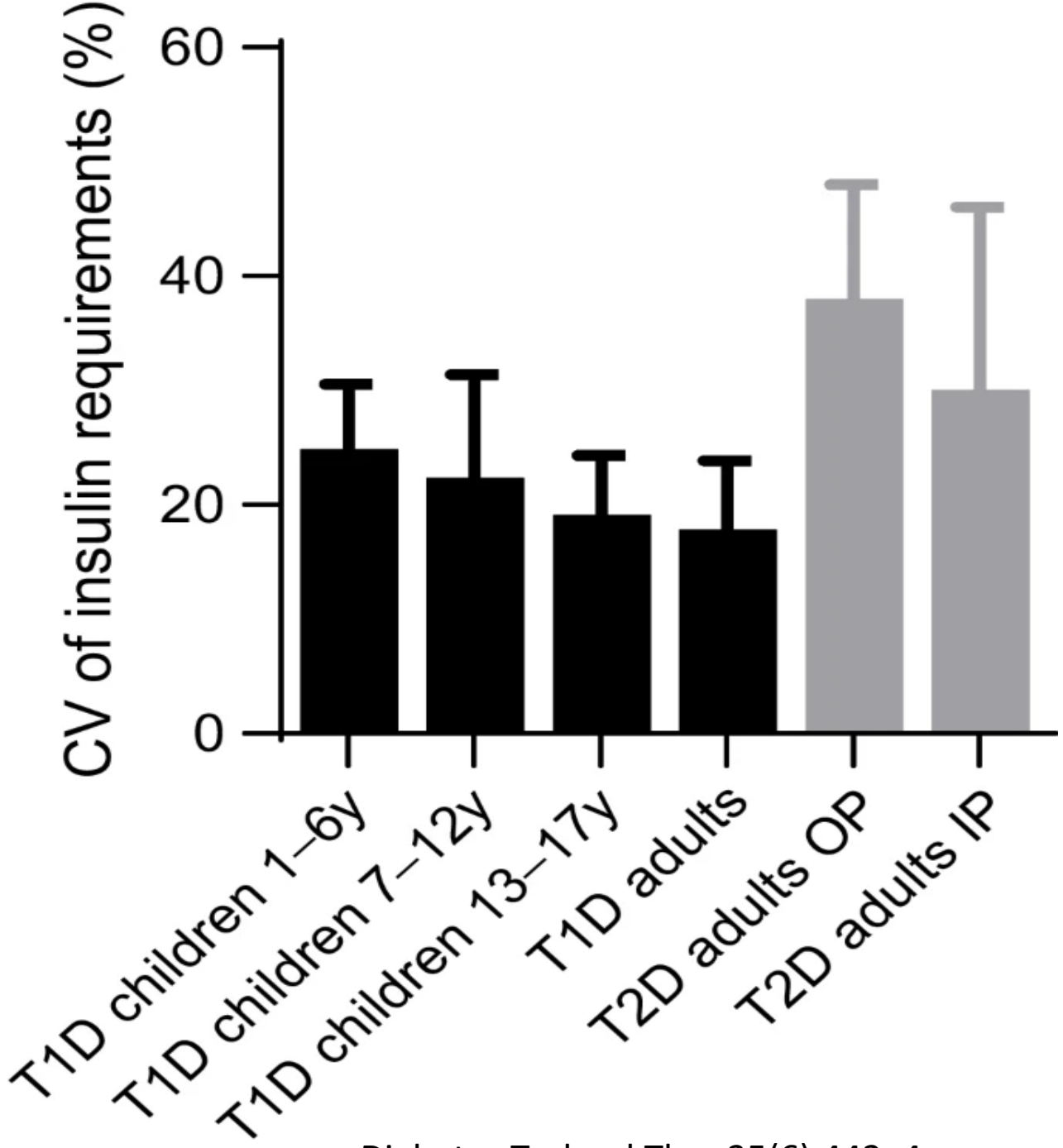
Celebrating the Data from 100,000 Real-World Users of the [redacted] System in Europe, Middle East, and Africa Collected Over 3 Years: From Data to Clinical Evidence

Data from over 20,000 HCL users in the USA were analysed. The time spent in target glucose range was 71.5% with 1% time spent below target range. More aggressive correction factor settings, insulin-to-carbohydrate ratio settings and basal programs were all associated with higher time in range but also, to a lesser degree, to higher time below target.

Diabetes Technol Ther. 2023;25(12):877-882

ORIGINAL ARTICLE

Therapy Settings Associated with Optimal Outcomes for [redacted] Technology in Real-World Clinical Care



Diabetes Technol Ther 25(6):442–4

People with T2D

- Data are lacking; RCTs are needed (no routine data published)
- **Comorbidities:** chronic renal failure, gastroparesis
- **Hospitalized people/surgery:** enable continued use if not contraindicated

Diabetologia. 2024;67(10):2059-2074

Older Adults > 65 Years

- Important target population
- Some studies included this ag group & new studies
- Studies addressing the impact of comorbidities are needed
- **Insufficient evidence, more studies are needed**

SID Società Italiana di Diabetologia 1964-2024 | 30° congresso nazionale | SID | con la collaborazione e la partecipazione di | AMD | RIMINI | Palacongressi di Rimini 23-26 Ottobre 2024

AOV: Azienda Ospedaliera Universitaria Luigi Vanvitelli
V: Università degli Studi della Campania Luigi Vanvitelli

GLUCOSE CONTROL IN SUBJECTS OVER 55 YEARS WITH TYPE 1 DIABETES IN TREATMENT WITH ARTIFICIAL PANCREAS

D. Forestiere[1], E. Raso[2], M. Caputo[2], M. Petrizzo[3], F. Castaldo[3], A. Palmieri[1], S. Arena[1], G. Bellastella[2,3], M.I. Maiorino[2,3], K. Esposito[2,3]

[1]PhD in Medicina Traslazionale, Dipartimento di Scienze Mediche e Chirurgiche Avanzate, Università degli Studi della Campania Luigi Vanvitelli, Napoli, Italia
[2]Dipartimento di Scienze Mediche e Chirurgiche Avanzate, Università degli Studi della Campania Luigi Vanvitelli, UOC Endocrinologia e Malattie del Metabolismo, AOU Luigi Vanvitelli, Napoli, Italia,
[3]UOC Endocrinologia e Malattie del Metabolismo, AOU Luigi Vanvitelli, Napoli, Italia

Aim: This study aims to evaluate the main metrics of glycemic control in people with type 1 diabetes aged 55 years or older, on treatment with an advanced hybrid closed loop systems.

Methods: This is a retrospective observational study of individuals with type 1 diabetes using advanced hybrid closed loop (AHCL) systems for at least six months and followed at a University Hospital of Southern Italy. Data on metrics of glucose control were collected at different times: **baseline** (*Time 0*), **after three months** (*Time 1*) and **after six months** (*Time 2*) of treatment with artificial pancreas. The primary endpoint was to evaluate the change in glucose management indicator *(GMI)* across the different time points.

Results: A total of 42 subjects were included in the study.
A significant increase of time in range (*TIR*) *(time 0 vs time 2, 47% vs 67%, P<0.001)* associated with a significant reduction of GMI *(time 0 vs time 2, 8%* vs 7.1 %, P<0.001), time above range *(TAR)* level 2 *(time 0 vs time 2, 22% vs 5%, P<0.001),* time below range *(TBR)* level 1 *(1% vs 0%, P<0.001)* and TBR level 2 *(0% vs 0%, P<0.001)* were observed in patients treated with artificial pancreas (*Table 1*).

Conclusions: Subjects aged over 55 years with type 1 diabetes in treatment with an artificial pancreas system showed a significant improvement in the main metrics of glucose control after six months of follow-up.

METRICS	PATIENTS (N = 42)			
	T0	T1	T2	P
GMI, %	8.0 (7.3, 8.7)	7.2 (7, 7.5)	7.1 (7.0, 7.5)	< 0.001
TIR, % (70-180 mg/dl)	47 (37, 62)	66 (58, 73)[1]	67 (59, 75)[1]	< 0.001
TAR 1, % (181-250 mg/dl)	29 (21, 33)	25(22, 29)	25 (21, 29)	0.052
TAR 2, % (251-400 mg/dl)	22 (7, 30)	7 (2, 13)	5 (3, 10)	< 0.001
TBR 1, % (54-69 mg/dl)	1 (0, 4)	1 (0, 1)	0 (0, 0)	<0.001
TBR 2, % (< 54 mg/dl)	0 (0.0, 1.0)	0 (0, 0)	0 (0, 0)	<0.001

Table 1 - Change in main glycemic metrics from monitoring in continuous glucose in the cohort of included patients at baseline (T0), after 3 months (T1) and after 6 months (T3) compared to the start of therapy with an artificial pancreas.

New indications
for closed-loop systems are emerging, including type 2 diabetes and cystic fibrosis related diabetes

Diabetologia. 2024;67(10):2059-2074

Looking for the balance

Awareness of Daily Glycemic Patterns and Trends

Improved awareness of impact of food/ behaviors

Increased anxiety, hopelessness and despair

Frequency of Attention

Constant availability of data facilitates greater attention to fine-tune and respond to out-of-range readings

Constant availability of data creates constant pressure to "serve" diabetes

Share Facility

Enhanced:

- Hypo confidence
- Well-being
- Sleep

Facilitates collaborative management approaches

- Feeling more judged
- Knowing too much about glucose readings
- Not knowing how best to respond

Alarms

Rapid notification that action may be required, facilitates responsiveness and confidence

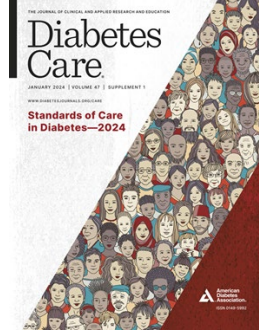
Intrusive, socially aversive, negative impact on others

Understanding Trend Arrows

Ability to see direction of travel quickly and respond accordingly

Need to understand what the arrows mean and how to respond to avoid "yo-yoing" BG levels

Barnard-Kelly KD, et al. J Diabetes Sci Technol. 2020;14:151-154; b. Polonsky WH, et al. Diabetes Technol Ther. 2022 Apr 26. doi: 10.1089/dia.2021.0526. [Epub ahead of print].



Insulin Pumps and Automated Insulin Delivery Systems

7.27 AID systems should be offered for diabetes management to youth and adults with type 1 diabetes A and other types of insulin-deficient diabetes E who are capable of using the device safely (either by themselves or with a caregiver). The choice of device should be made based on the individual's circumstances, preferences, and needs. **A**

7.28 Insulin pump therapy alone with or without a sensor-augmented pump low-glucose suspend feature should be offered for diabetes management to youth and adults on MDI with type 1 diabetes A or other types of insulin-deficient diabetes E who are capable of using the device safely (either by themselves or with a caregiver) and are **not able to use or do not choose an AID system**. The choice of device should be made based on the individual's circumstances, preferences, and needs. **A**

GRADO DI RACCOMANDAZIONE

Raccomandazione forte a favore dell'intervento, con qualità delle prove moderata.

In soggetti con diabete mellito di tipo 1 scompensato si raccomanda di offrire al paziente l'opzione di una terapia insulinica mediante microinfusore di insulina rispetto alla terapia insulinica multiniettiva per i vantaggi sui livelli di emoglobina glicata, le ipoglicemie severe, la qualità di vita e la soddisfazione per il trattamento.

In soggetti con diabete mellito di tipo 1 non scompensato si suggerisce di offrire al paziente l'opzione di una terapia insulinica mediante microinfusore di insulina rispetto alla terapia insulinica multiniettiva per i vantaggi su variabilità glicemica, qualità di vita e soddisfazione per il trattamento.

Raccomandazione forte a favore dell'intervento, con qualità delle prove alta.

In soggetti con diabete mellito di tipo 1 si raccomanda l'utilizzo di sistemi ad ansa chiusa costituiti da microinfusore e sensore con automatismo rispetto all'uso di sistemi senza automatismo.

Versione aggiornata a gennaio 2024

Diabete Tipo 1

GRADO DI RACCOMANDAZIONE

Raccomandazione debole a sfavore dell'intervento, con qualità delle prove molto bassa

L'utilizzo routinario del microinfusore di insulina nei pazienti con diabete di tipo 2 non adeguatamente controllati non è raccomandato.

Motivazione della raccomandazione

Non ci sono evidenze di reali vantaggi derivanti dall'uso del microinfusore nei pazienti con diabete di tipo 2 rispetto alla terapia multi-iniettiva. Inoltre i costi per tale terapia sono molto elevati.
La qualità delle evidenze è molto bassa per la maggior parte degli *outcome* critici, in particolare per il disegno in aperto della maggior parte degli studi inclusi, la presenza di elevata eterogeneità e la scarsa numerosità di pazienti arruolati.
Non ci sono studi specifici di natura economica per valutare la costo-efficacia dell'intervento proposto in pazienti con diabete di tipo 2.

Considerazioni su sottogruppi di pazienti

I microinfusori potrebbero avere dei vantaggi in alcuni specifici sottogruppi di pazienti con diabete di tipo 2 come quelli con necessità di basalizzazione diversa durante le ore notturne, ovvero i pazienti che non riescono a controllare la glicemia al risveglio perché le esistenti formulazioni di insuline basali non permettono la necessaria flessibilità. Mancano tuttavia studi o analisi per sottogruppo che prendano in considerazioni questa categoria di pazienti con diabete di tipo 2.

Versione aggiornata a dicembre 2022

Diabete Tipo 2

REGIONE CAMPANIA

Delibera della Giunta Regionale n. 794 del 29/12/2023

Dipartimento 50 - GIUNTA REGIONALE DELLA CAMPANIA

Direzione Generale 4 - DG per la tutela della salute e il coordin. del sist. sanitario regionale

Oggetto dell'Atto:

AGGIORNAMENTO LINEE DI INDIRIZZO PER LA PRESCRIZIONE DELLE TECNOLOGIE APPLICATE AL TRATTAMENTO E ALL'AUTOCONTROLLO DEL DIABETE MELLITO.

INDIRIZZO DI MASSIMA ALL'UTILIZZO DI TECNOLOGIE APPLICATE AL TRATTAMENTO INSULINICO ED ALL' AUTOCONTROLLO DEL DIABETE MELLITO

In accordo a quanto previsto dalle attuali linee guida nazionali, ed internazionali, il tipo e la scelta della tecnologia da utilizzare deve essere individualizzata sulla base delle specifiche necessità, preferenze e livello di abilità del singolo paziente. In contesti in cui la gestione del diabete è completamente o in parte svolta da altri (es. bambini piccoli, persone con alterazioni del livello cognitivo o delle abilità manuali, psicosociali o con limitazioni fisiche) le capacità e le preferenze del caregiver vanno considerate ai fini del processo decisionale.

MONITORAGGIO IN CONTINUO DEL GLUCOSIO:
*PAZIENTI IN **ETÀ ADULTA** CHE SIANO **IN GRADO DI UTILIZZARE** IL SISTEMA E CHE **ACCETTINO** DI INDOSSARLO*

*SISTEMI **RTCGM** O CON RILEVAZIONE INTERMITTENTE MEDIANTE SCANSIONE DEL SENSORE (**ISCGM**) DEL GLUCOSIO **CON ALLARMI SOGLIA***

- DT1 in terapia insulinica multi-iniettiva o con microinfusore di insulina
- Diabete tipo 2 (DT2) o diabete secondario in terapia insulinica multi-iniettiva (insulina basale + almeno due somministrazioni al giorno di analogo ad azione rapida o ultra-rapida dell'insulina)
- Donne con diabete pre-gestazionale e gestazionale in terapia insulinica (insulina basale + almeno una somministrazione di insulina rapida al giorno)
- DT2 o altri tipi di diabete in terapia insulinica che praticano meno di tre somministrazioni/die ad alto rischio di ipoglicemia, in cui, per condizioni lavorative o stili di vita, un controllo frequente è consigliabile ma non praticabile
- Pazienti con sindromi ipoglicemiche in controllo terapeutico inadeguato (Es. glicogenosi, mutazioni ABCC8, insulinoma, ecc.)

*SISTEMI CON RILEVAZIONE DELLA GLICEMIA CONTINUA IN REAL-TIME (**RTCGM**) **CON ALLARME PREDITTIVO***

- Adulti con diabete mellito in MDI/CSII con ipoglicemia problematica per la vita del paziente: asintomatica, ricorrente, severa
- Donne con DT1 in gravidanza in terapia MDI per migliorare il compenso metabolico e gli outcomes neonatali (solo dispositivi con sensore transcutaneo)
- Pazienti con diabete e comorbidità rilevanti e/o complicanze microvascolari (cardiopatia ischemica, IRC di stadio avanzato, neuropatia autonomica vegetativa, gastroparesi, retinopatia diabetica) che presentano ipoglicemie ripetute

*UTILIZZO OCCASIONALE DI SISTEMI **CGM** **CON ALLARMI SOGLIA***

- DT2 in terapia insulinica non intensiva
- Terapia insulinica limitata nel tempo (es. Intervento chirurgico)
- Paziente ospedalizzato
- Patologie endocrine associate (panipopituitarismo,insufficienza corticosurrenalica)
- Patologia oncologica in terapia cortisonica
- Diagnosi differenziale delle ipoglicemie

Delibera della Giunta Regionale n. 794 del 29/12/2023

Dipartimento 50 - GIUNTA REGIONALE DELLA CAMPANIA

Direzione Generale 4 - DG per la tutela della salute e il coordin. del sist. sanitario regionale

Oggetto dell'Atto:

AGGIORNAMENTO LINEE DI INDIRIZZO PER LA PRESCRIZIONE DELLE TECNOLOGIE APPLICATE AL TRATTAMENTO E ALL'AUTOCONTROLLO DEL DIABETE MELLITO.

MICROINFUSORI E PANCREAS ARTIFICIALE :

*PAZIENTI IN **ETÀ ADULTA** CHE SIANO **IN GRADO DI UTILIZZARE** IL SISTEMA E CHE **ACCETTINO** DI INDOSSARLO*

*INDICAZIONI ALLA PRESCRIZIONE DEL **MICROINFUSORE***

persone con diabete tipo 1 o altri tipi di diabete in terapia MDI (es. secondario a pancreasectomia), utilizzatori di CGM, che non accettano il pancreas artificiale e presentano:

- HbA1c persistentemente superiore al target desiderabile nonostante MDI intensiva e ottimizzata
- necessità di particolare nello stile di vita
-elevata insulino-sensibilità (fabbisogno insulinico quotidiano < 20 UI/die o < 0.4 U/Kg)
-agofobia
-ipoglicemie gravi, ricorrenti e/o variabilità glicemica

Persone con diabete tipo 2 in terapia insulinica multi-iniettiva con almeno 4 somministrazioni/die e utilizzatori di CGM che presentano episodi di ipoglicemia

*INDICAZIONI ALLA PRESCRIZIONE DI **SAP** CON FUNZIONE DI INTERRUZIONE DELLA SOMMINISTRAZIONE DELL'INSULINA IN CASO DI PREDIZIONE DI UNA IPOGLICEMIA DA PARTE DEL SENSORE **(PLGS)***

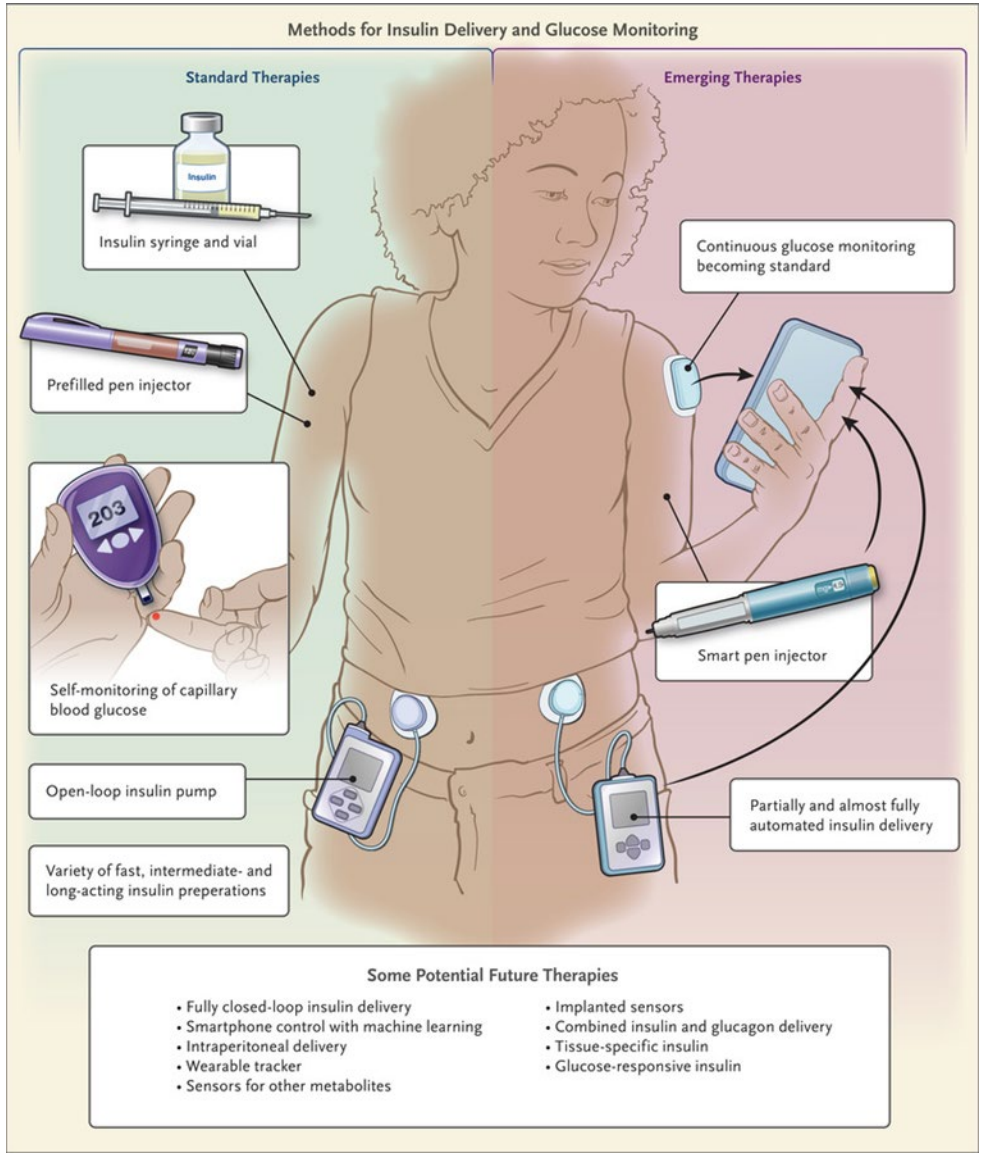
Persone con diabete tipo 1 o altri tipi di diabete in fase di scompenso, con elevata variabilità glicemica (HbA_{1c}> 7.0 % CV > 36%) e ipoglicemie frequenti, non candidabili per la gestione di sistemi integrati HCL/AHCL per raggiungere il target, o che non accettano tale sistema

*INDICAZIONI ALLA PRESCRIZIONE DI **SAP** CON FUNZIONE DI PANCREAS ARTIFICIALE IBRIDO (**HCLS**)*

Persone con DT1 o altri tipi di diabete (es. secondario a pancreasectomia)

Persone con DT2 in terapia insulinica multi-iniettiva con almeno 4 somministrazioni/die e aumentato rischio di ipoglicemia


Delibera della Giunta Regionale n. 794 del 29/12/2023



There has been incredible progress in the field of diabetes management, largely owing to technological development.

While diabetes technology has been game-changing, with a multitude of clinical benefits for people living with diabetes, we must be mindful of the difficulties that arise with the use of these technologies, such as information overload, technical issues and frequent alarms that can be overwhelming

The ongoing and next steps are aimed at evaluating the role of diabetes technologies in precision medicine in order to provide personalised medicine using an holistic approach.

Università degli Studi della Campania Luigi Vanvitelli

UOC di Endocrinologia e Malattie del Metabolismo

Direttore: Prof. Katherine Esposito

Napoli, Policlinico del Centro Storico 17.09.2024