Continuous Glucose Monitoring in type 2 diabetes

Mojtaba Malek

Institute of Endocrinology and Metabolism

Iran University of Medical Sciences

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Agenda

- **Introduction**
- **Effect of rtCGM on lifestyle modification**
- **Effect of rtCGM on glycemic control**
- **Effect of rtCGM on hypoglycemia**
- **Guidelines Recommendations for CGM Use in the Management of Type 2 Diabetes**
- **Summary**

Introduction cont.

- As more data have emerged clarifying **the importance of glucose monitoring**
- It has become apparent that treating diabetes **without monitoring** is comparable to taking a long trip in an automobile without the benefit of a map
- Despite glucose meters becoming smaller, faster, and more accurate, **adherence to SMBG** is difficult
- **CGM is having the greatest impact** among the remarkable advances in diabetes technology in the past decade
-

Introduction cont.

- Several studies demonstrated **improvement in glycemic control and reduction in hypoglycemia** with the use of CGM in patients with T1D
- On the other hand, the **prevalence of type 2 diabetes (T2D) is higher than T1D**, and over time, insulin often becomes necessary to achieve glycemic control
- It seems like there is a potential role of CGM in T2D as well

Effect of rtCGM on lifestyle modification

JDI Journal of Diabetes Investigation Open access
Official Journal of the Asian Association for the Study of Diabetes
REVIEW ARTICLE

Effectiveness and acceptability of continuous glucose monitoring for type 2 diabetes management: A narrative review

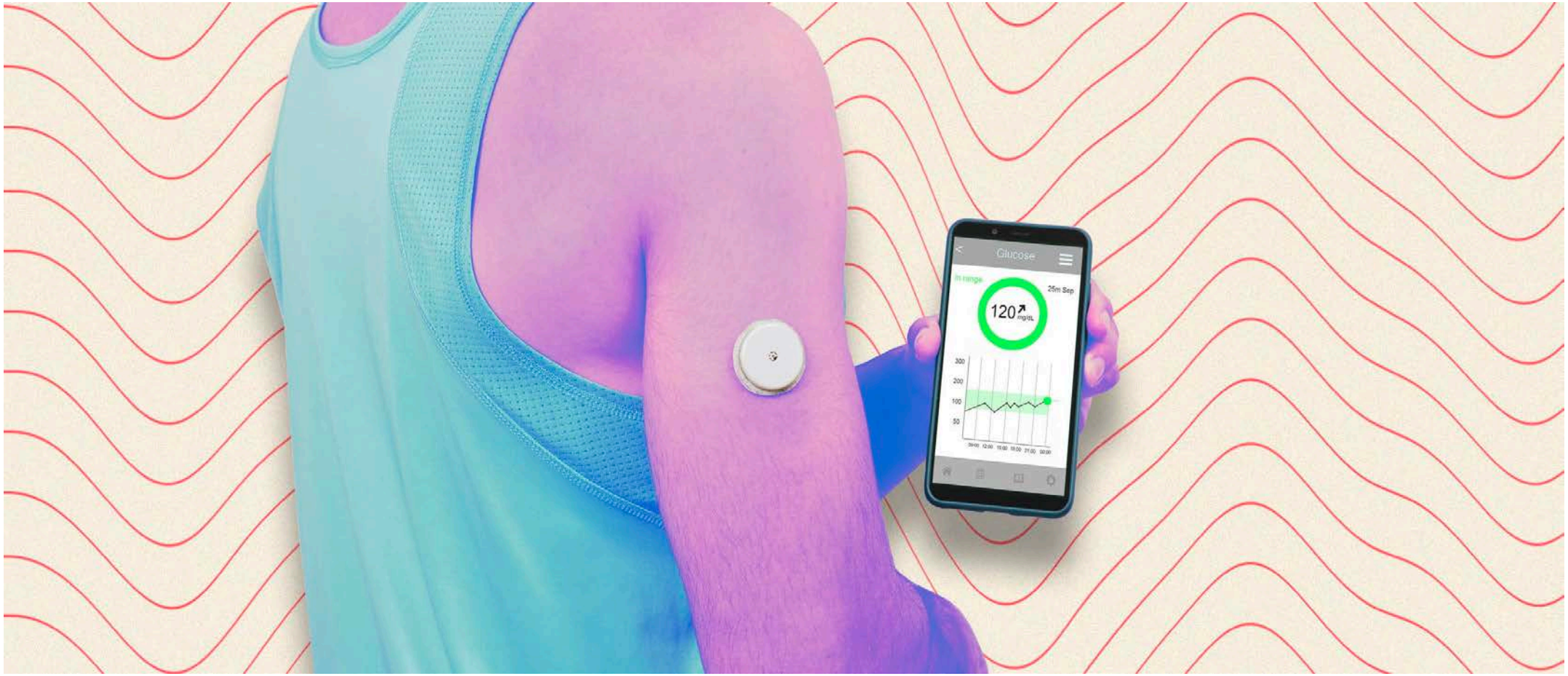
Pennie J Taylor[1,2]*, Campbell H Thompson[2], Grant D Brinkworth[3]

[1]CSIRO, Health and Biosecurity, [2]Discipline of Medicine, School of Medicine, University of Adelaide, Adelaide, South Australia, and [3]CSIRO, Health and Biosecurity, Sydney, New South Wales, Australia

In a systematic review included 5542 participants from 11 studies
Compared with traditional self-monitoring of blood glucose levels, CGM promoted greater reductions in glycated hemoglobin, bodyweight and caloric intake; higher adherence rating to a personal eating plan; and increases in physical activity

J Diabetes Investig 2018; 9: 713–725

Effect of rtCGM on glycemic control



Annals of Internal Medicine

ORIGINAL RESEARCH

Continuous Glucose Monitoring Versus Usual Care in Patients With Type 2 Diabetes Receiving Multiple Daily Insulin Injections

A Randomized Trial

Roy W. Beck, MD, PhD; Tonya D. Riddlesworth, PhD; Katrina Ruedy, MSPH; Andrew Ahmann, MD; Stacie Haller, RD, LD, CDE; Davida Kruger, MSN, APN-BC; Janet B. McGill, MD; William Polonsky, PhD; David Price, MD; Stephen Aronoff, MD; Ronnie Aronson, MD; Elena Toschi, MD; Craig Kollman, PhD; and Richard Bergenstal, MD, for the DIAMOND Study Group*

Objective: To determine the effectiveness of CGM in adults with type 2 diabetes **receiving multiple daily injections of insulin**

Design: **RCT**

Patients: 158 adults who had had type 2 diabetes

Intervention: Random assignment to CGM (*n* = 79) or usual care (control group, *n* = 79).

Measurements: The primary outcome was HbA_{1c} reduction at 24 weeks

Annals of Internal Medicine · August 2017, DOI: 10.7326/M16-2855

Table 2. Comparison of HbA_{1c} Outcomes at 12 and 24 Weeks in the CGM and Usual Care Groups*

Outcome	12 wk		
	CGM Group ($n = 77$)	Control Group ($n = 75$)	Adjusted Difference (95% CI); *P* Value†
Primary outcome			
Mean HbA_{1c} level (95% CI), %	7.5 (7.4 to 7.7)	7.9 (7.7 to 8.1)	-
Mean change in HbA_{1c} level from baseline (95% CI), %	−1.0 (−1.2 to −0.8)	−0.6 (−0.8 to −0.4)	−0.3 (−0.6 to −0.1); 0.005
Secondary outcomes‡			
HbA_{1c} level <7.0%, *n (%)*	17 (22)	9 (12)	10% (−2% to 23%); 0.26
HbA_{1c} level <7.5%, *n (%)*	35 (45)	22 (29)	17% (−3% to 37%); 0.054
Relative reduction in HbA_{1c} level ≥10%, *n (%)*	44 (57)	26 (35)	25% (3% to 46%); 0.016
Reduction in HbA_{1c} level ≥1%, *n (%)*	40 (52)	25 (33)	20% (−1% to 41%); 0.044
Reduction in HbA_{1c} level ≥1% or HbA_{1c} level <7.0%, *n (%)*	41 (53)	25 (33)	22% (0% to 43%); 0.034
Reduction in HbA_{1c} level ≥0.5%, *n (%)*	61 (79)	38 (51)	31% (5% to 57%); 0.002

Results: Mean HbA1c levels decreased to 7.7% in the CGM group and 8.0% in the control group at 24 weeks (**adjusted difference in mean change, 0.3%** [95% CI, 0.5% to 0.0%]; *P* =0.022)

The groups **did not differ meaningfully** in CGM measured **hypoglycemia** or **quality-of-life outcomes**.

Research

JAMA | Original Investigation

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

Thomas Martens, MD; Roy W. Beck, MD, PhD; Ryan Bailey, MS; Katrina J. Ruedy, MSPH; Peter Calhoun, PhD; Anne L. Peters, MD; Rodica Pop-Busui, MD, PhD; Athena Philis-Tsimikas, MD; Shichun Bao, MD, PhD; Guillermo Umpierrez, MD; Georgia Davis, MD; Davida Kruger, MSN, APN-BC; Anuj Bhargava, MD; Laura Young, MD, PhD; Janet B. McGill, MD; Grazia Aleppo, MD; Quang T. Nguyen, DO; Ian Orozco, MD; William Biggs, MD; K. Jean Lucas, MD; William H. Polonsky, PhD; John B. Buse, MD, PhD; David Price, MD; Richard M. Bergenstal, MD; for the MOBILE Study Group

- **DESIGN:** RCT
- **PARTICIPANTS**: Adults with type 2 diabetes receiving 1 or 2 daily injections of long- or intermediate-acting basal insulin
- **INTERVENTIONS:** Random assignment 2:1 to CGM (n = 116) or traditional SMBG (n = 59)
- **PRIMARY OUTCOME**: (HbA1c) level at 8 months

JAMA. 2021;325(22):2262-2272. doi:10.1001/jama.2021.7444

Results:
In the CGM group compared with the BGM group

- **Adjusted difference of HbA1c level** : **-0.4%** [95% CI, -0.8% to -0.1%]; *P* = .02
- **The adjusted difference of CGM-measured TIR : 15%** [95% CI, 8% to 23%]; *P* < .001)
- **Severe hypoglycemic events was not significant**
- **CONCLUSIONS** :Among adults with poorly controlled type 2 diabetes treated with basal insulin, CGM, as compared with SMBG, resulted in significantly lower HbA1c levels at 8 months

JAMA. 2021;325(22):2262-2272. doi:10.1001/jama.2021.7444

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DOI: 10.1111/dom.15328

ORIGINAL ARTICLE

WILEY

Effects of continuous glucose monitoring on glycaemic control in type 2 diabetes: A systematic review and network meta-analysis of randomized controlled trials

Jiaping Lu MD[1] | Zhen Ying PhD[2] | Ping Wang MD[1] | Minjie Fu PhD[3] | Chenyu Han MD[1] | Min Zhang PhD[1]

Diabetes Obes Metab. 2023;1–11.

Effect of CGM on glycated haemoglobin (%) change

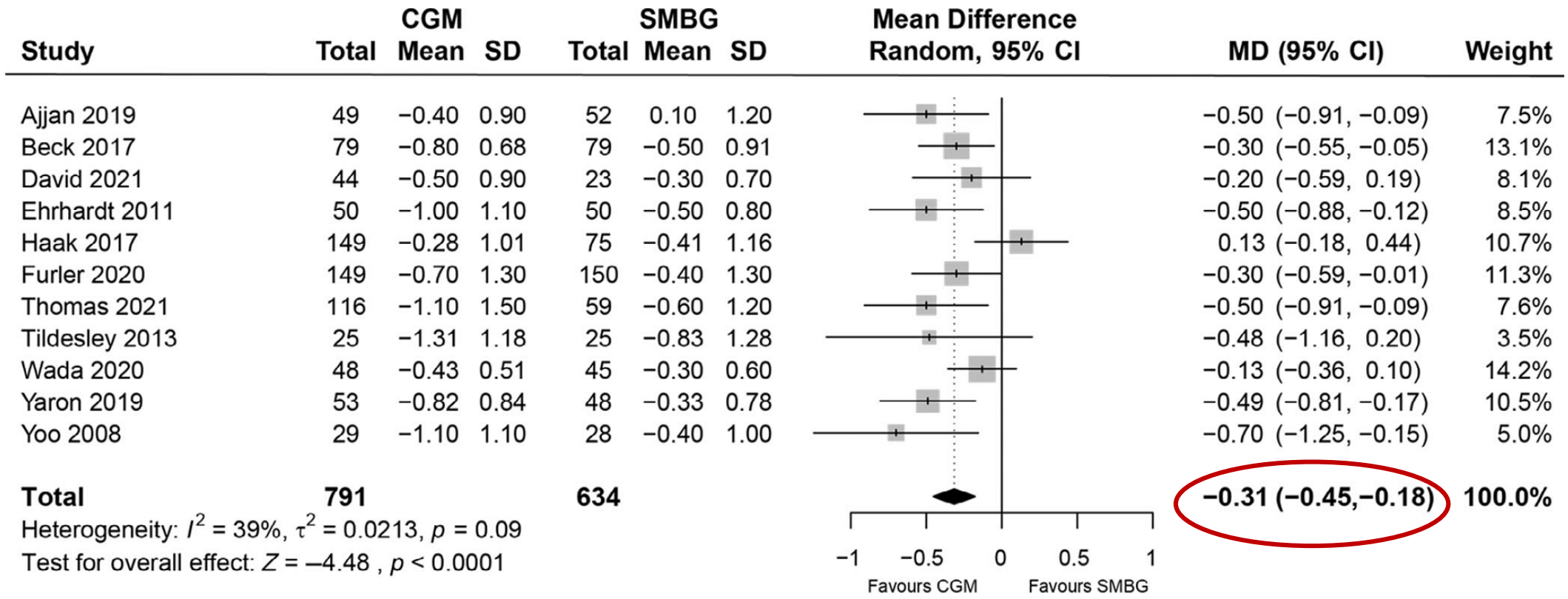
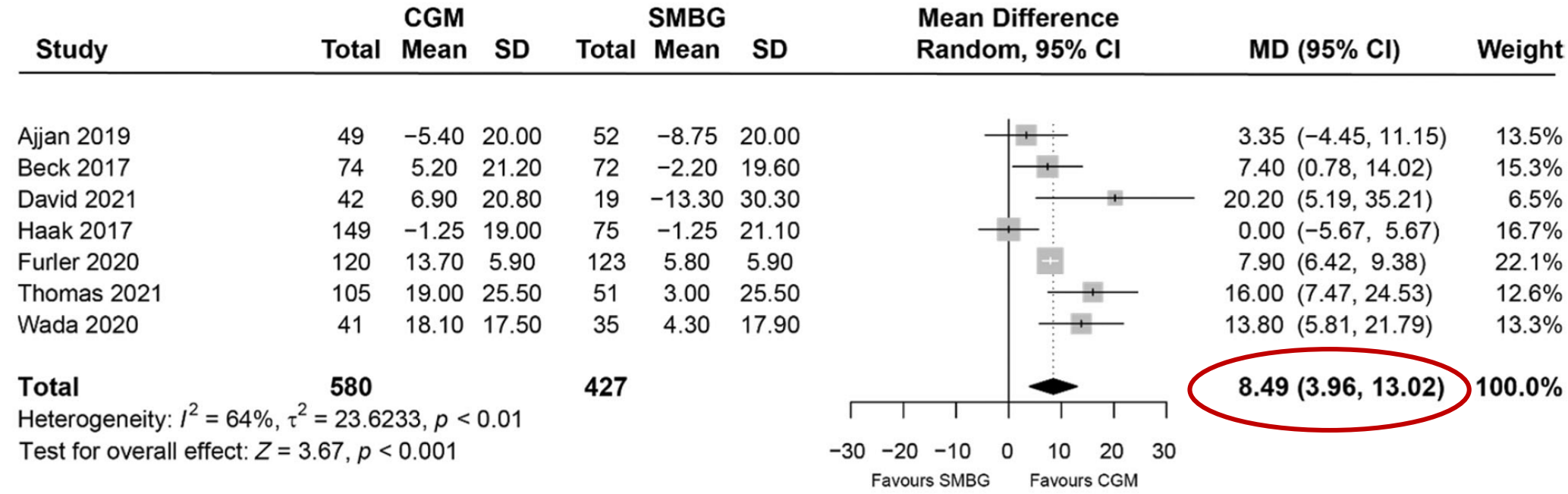


FIGURE 2 Forest plot showing the effect of CGM on glycated haemoglobin (%) change. CGM, continuous glucose monitoring; CI, confidence interval; MD, mean difference; SD, standard deviation; SMBG, self-monitoring of blood glucose.

Diabetes Obes Metab. 2023;1–11.

Time in range

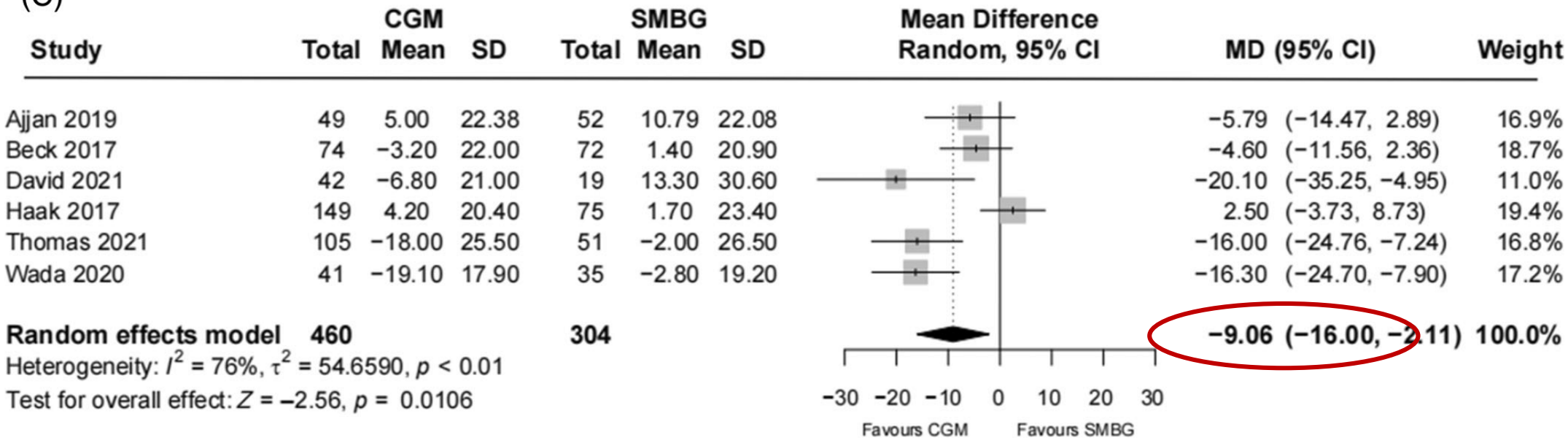
(A)



Diabetes Obes Metab. 2023;1–11.

Time above range

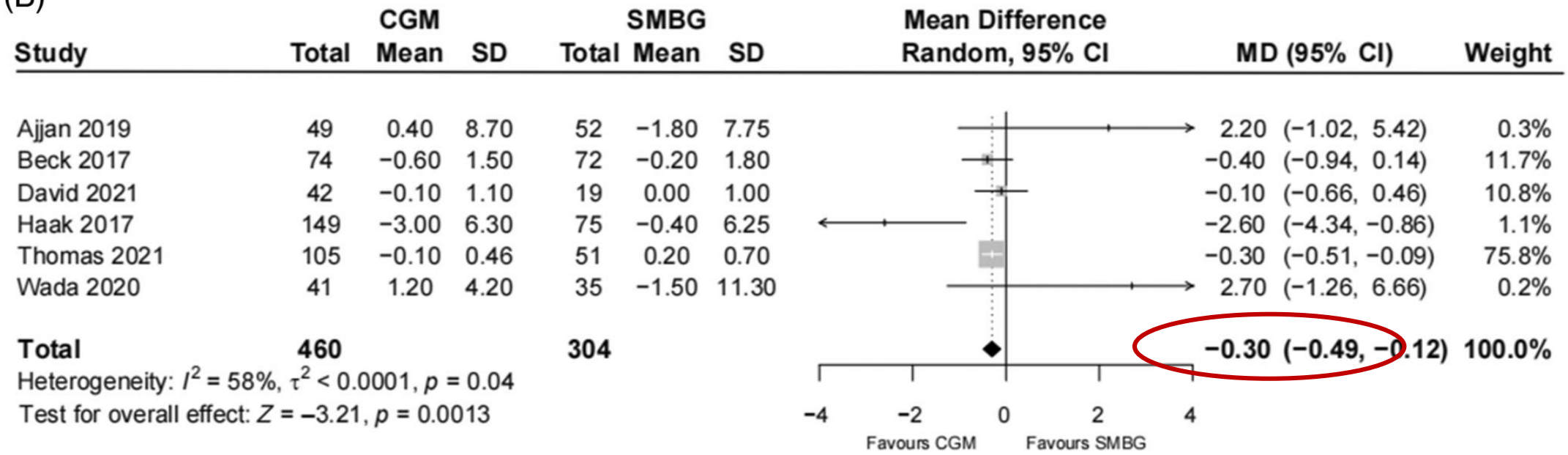
(C)



Diabetes Obes Metab. 2023;1–11.

Time below range

(B)



Diabetes Obes Metab. 2023;1–11.

Conclusion

- This systematic review showed that CGM improves glycaemic control,including HbA1c, TIR, TBR and TAR, in individuals with T2DM

Diabetes Obes Metab. 2023;1–11.

Effect of rtCGM on hypoglycemia

Original Article

Hypoglycemia in Type 2 Diabetes - More Common Than You Think: A Continuous Glucose Monitoring Study

Journal of Diabetes Science and Technology
2015, Vol. 9(5) 999–1005

DOI: 10.1177/1932296815581052
dst.sagepub.com
SAGE

Richa Redhu Gehlaut, MD[1], Godwin Y. Dogbey, PhD[2], Frank L. Schwartz, MD, FACE[3], Cynthia R. Marling, PhD[4], and Jay H. Shubrook, DO, FACOFP, FAAFP, BC-ADM[5]

- In this study 108 patients with T2DM on a mix of insulin and noninsulin agents wore a CGMS
- 49% of individuals experienced hypoglycemia at least once during a 5-week, and that many of these episodes were asymptomatic
- In addition,21% of patients had blood glucose levels of 50mg/dL or lower
-

Effect of rtCGM on hypoglycemia

- **Several studies have suggested that SMBG underreports hypoglycemia in patients with T2D, and it is thought that CGM would more effectively detect hypoglycemia**

- The main question, however, is whether rtCGM is effective in reducing hypoglycemia in this population

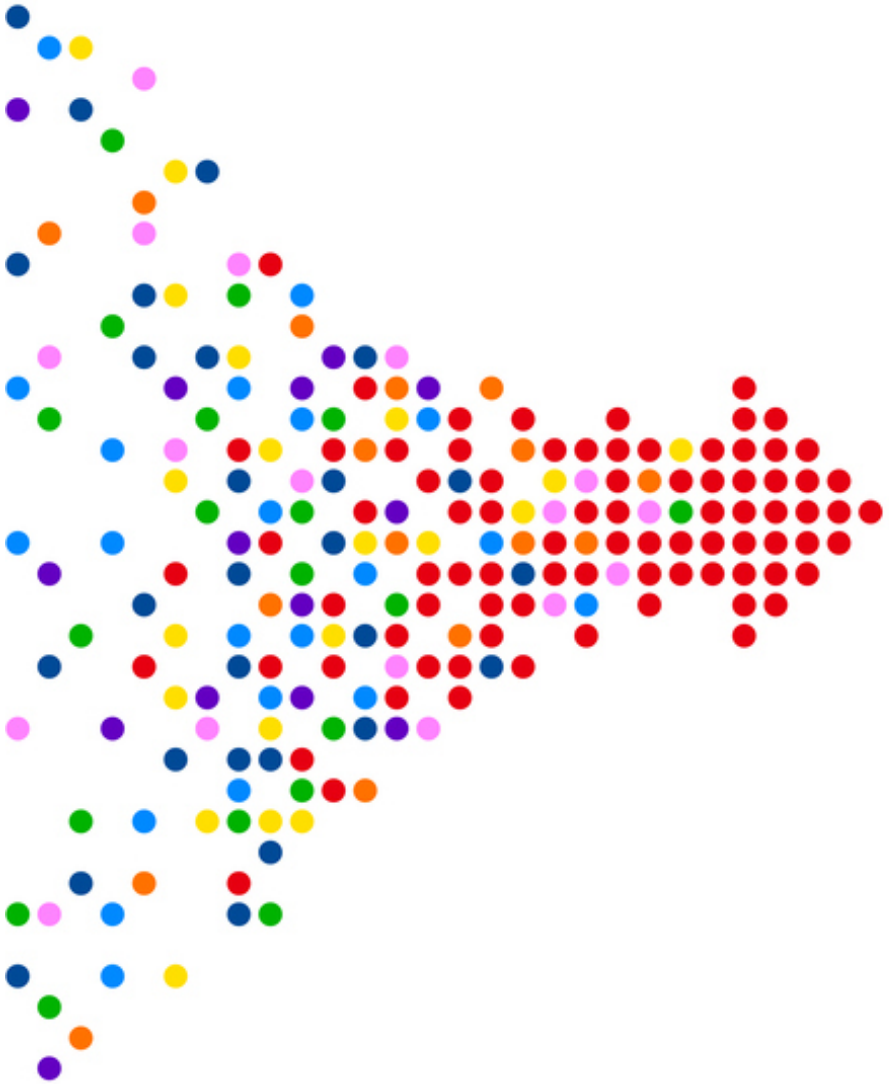
- **The DIAMOND Study** as the largest prospective trial of subjects with T2D treated with MDI did not find a statistically significant reduction in hypoglycemia less than 70 mg/dL with use of rtCGM

Annals of Internal Medicine · August 2017, DOI: 10.7326/M16-2855

Effect of rtCGM on hypoglycemia

- Despite the very high prevalence of hypoglycemia in patients with T2D, **there is no RCT** using rtCGM **with the primary objective of hypoglycemia reduction**
- T2D patients with hypoglycemia unawareness or with a greater percentage of hypoglycemia at baseline are likely to benefit from rtCGM
- However, further studies are necessary to establish evidence of rtCGM utility in hypoglycemia prevention or reduction

Guidelines



ADA 2023

Recommendations 7.11

- **Real-time continuous glucose monitoring A** or **intermittently scanned continuous glucose monitoring B** should be offered for diabetes management **in adults with diabetes** on **multiple daily injections** or **continuous subcutaneous insulin infusion** who are capable of using the devices safely

Diabetes Care 2023;46(Suppl. 1):S111–S127 | https://doi.org/10.2337/dc23-S007

ADA 2023:
Recommendations 7.12

- **Real-time continuous glucose monitoring A** or **intermittently scanned continuous glucose monitoring C should be offered** for diabetes management in **adults with diabetes on basal insulin** who are capable of using the devices safely

Diabetes Care 2023;46(Suppl. 1):S111–S127 | https://doi.org/10.2337/dc23-S007

ADA 2023:
Recommendations 7.17

- **Periodic use of real-time** or **intermittently scanned continuous** glucose monitoring or use of professional continuous glucose monitoring **can be helpful** for diabetes management in circumstances where continuous use of continuous glucose monitoring is not appropriate, desired, or available

Diabetes Care 2023;46(Suppl. 1):S111–S127 | https://doi.org/10.2337/dc23-S007

Professional Society Recommendations for CGM Use in the Management of Type 2 Diabetes

TABLE 3. PROFESSIONAL SOCIETY RECOMMENDATIONS FOR CONTINUOUS GLUCOSE MONITORING USE IN THE MANAGEMENT OF TYPE 2 DIABETES

Professional society (reference)	*Recommendations*
ADA[55]	When used properly, real-time continuous glucose monitors in conjunction with multiple daily injections and continuous subcutaneous insulin infusion [A], and other forms of insulin therapy [C] are a useful tool to lower and/or maintain A1C levels and/or reduce hypoglycemia in adults and youth with diabetes. Use of professional CGM and/or intermittent real-time or intermittently scanned CGM can be helpful in identifying and correcting patterns of hyperglycemia and hypoglycemia, and improving A1C levels in people with diabetes on noninsulin, as well as basal insulin regimens. [C]
AACE[56]	CGM devices should be considered for patients with T1D and T2D who are on intensive insulin therapy to improve HbA1c levels and reduce hypoglycemia (Grade B), early reports suggest that even patients not taking insulin may benefit from CGM (Grade D).
The Endocrine Society[57,58]	We suggest short-term, intermittent rtCGM use in adult patients with T2DM (not on prandial insulin), who have A1c levels >7% and are willing and able to use the device. (2|⊕⊕◯◯)

ADA level A evidence—high-level, clear evidence from well conducted, generalizable RCT, ADA level C evidence—supportive evidence from well-conducted studies. AACE grade B evidence is intermediate level, while D means not evidence based. Endocrine society level of evidence 2|⊕⊕ means weak, low-quality evidence.

AACE, American Association of Clinical Endocrinologists; ADA, American Diabetes Association; T1D, type 1 diabetes.

DIABETES TECHNOLOGY & THERAPEUTICS,Volume 23, Supplement 1, 2021

Summary

- The development of CGM has had a profound impact on the field of diabetes

- With the well-established and still growing evidence base supporting personal CGM in T1D, more recently in T2D with intensive insulin therapy, and most recently in T2D with any insulin therapy, CGM recommendations in professional guidelines have expanded

- It is not yet clear what the role of CGM will be for those not on insulin, but evidence is beginning to accumulate