

# THE **sensor** report

ISSUE 1/2024

## WELCOME TO THE SENSOR REPORT, ISSUE 1, 2024

In this first issue of The Sensor Report for 2024, we have given emphasis to the importance of using sensor-based glucose monitoring technologies in the management of diabetes in older individuals with diabetes, who may be frail and vulnerable. The prevalence of type 2 diabetes (T2DM) amongst the older population is rising<sup>1</sup> and it is important to optimize their glycemic control, while minimizing risks for hypoglycemia and hyperglycemia-related complications. Importantly, older adults with T2DM are also more likely to have one or more co-existing conditions, including cognitive impairment, cardiovascular disease, renal failure, and degrees of frailty that will require management in the context of their glycemic health and overall quality of life (QoL). Our feature story identifies and discusses the key research which reveals that symptomatic and asymptomatic hypoglycemia is frequent in frail, older populations living with T2DM, including those on non-insulin therapy. In this population, HbA1c is not a good predictor for hypoglycemia. However, older people living with diabetes are able to use diabetes technology effectively, with important benefits for glycemic control and improvements in QoL.

In this issue we also showcase studies that provide evidence beyond glycemic control, showing that application of the FreeStyle Libre systems has significant benefits for improved quality of life and emotional wellbeing for people with diabetes, including reduced workplace absenteeism. The influence of CGM devices

on behaviour-change for people with diabetes is also now emerging. Significantly, use of the FreeStyle Libre systems is shown to help healthcare professionals facilitate more-tailored support for people with diabetes, both within and between clinic visits. The use of mobile health (mHealth) platforms and devices is also emphasized in this context.

As always, The Sensor Report also highlights many recent studies that investigate the impact of using sensor based glucose monitoring technologies, such as the FreeStyle Libre systems, to improve important glycemic outcomes in people with diabetes.



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1. Sun H, et al. IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabetes Res Clin Pract.* 2022; 183:109119

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## featurestory

### Age is not a barrier to effective use of CGM technology

A predicted doubling of the aged population, coupled with the increasing prevalence of diabetes with age, means that up to 33% of persons aged 65 years or older are predicted to require treatment in the coming decades<sup>1</sup>. Compared to younger people with diabetes, this older population of people living with diabetes is also more at risk of developing long-term diabetes complications, such as cardiovascular disease, kidney failure, retinopathy and neuropathy<sup>2</sup>.

Using blinded CGM, it has been confirmed that both symptomatic and asymptomatic hypoglycemia is common in older people with T2DM, including those

on non-insulin therapy, independent of their HbA1c<sup>3</sup>. Nocturnal hypoglycemia is also common and largely underdiagnosed<sup>4</sup>. Older people living with T2DM are also more likely to have impaired awareness of hypoglycemia (IAH)<sup>5</sup>, possibly because longer duration of disease is associated with reductions in endogenous insulin production, leading to a lessened protective counter-regulatory hormone response. The risk of severe or fatal hypoglycemia is therefore considerable in older persons with diabetes who are treated with insulinotropic medications<sup>6-8</sup>. The use of glucose sensors can be predicted to reduce these risks and improve outcomes.

To date, few studies have centred on the use of glucose-sensing technologies in older people with diabetes, and current clinical guidelines do not adequately define 'older' as it applies to those living with diabetes<sup>9</sup>.

The REPLACE RCT in people with T2DM on intensive insulin therapy found that a subgroup of participants  $\geq 65$  years old in the intervention group using the FreeStyle Libre system had a 44% reduction in TBR 70 mg/dL (3.9 mmol/L), which was comparable to subjects  $< 65$  years old<sup>10</sup>. Using data from the MOBILE RCT, Bao and colleagues reported that people  $\geq 65$  years old with T2DM on basal insulin therapy were able to improve TIR and reduce TBR after starting traditional CGM, at least as significantly as younger adults<sup>11</sup>.

The REFER study<sup>12</sup> investigating the impact of flash glucose monitoring on adults with T2DM on basal-bolus insulin treatment in France, Austria and Germany, included 185 individuals aged  $\geq 65$  years. After 3-6 months of flash glucose monitoring, this subgroup of older people with T2DM achieved a -8.5 mmol/mol (0.8%) reduction in HbA1c from baseline, which was not different from individuals  $< 65$  years old.

The RELIEF retrospective study in France identified 38,312 people aged  $\geq 65$  years with T2DM on intensive insulin therapy who had initiated the FreeStyle Libre system during the study period<sup>13</sup>. Hospitalizations for acute diabetes events (ADEs) were observed in 1.60% of this cohort in the 12 months before initiation of flash glucose monitoring, compared to 1.05% after 12 months and 0.96% after 24 months, a 34% and 40% reduction, respectively. Reduced ADEs were driven by a fall in admissions for DKA after 12 months and by fewer admissions for severe hypoglycemia at 24 months.

### Proficiency with CGM for older individuals with diabetes

The psychosocial impact of using the FreeStyle Libre system was investigated using the diabetes treatment satisfaction questionnaire (DTSQ) in 267 adults with T2DM aged  $\geq 65$  years, following a 6-month period using the FreeStyle Libre system<sup>14</sup>. Compared to the prior 6-month period using SMBG, using the FreeStyle Libre system was associated with a significant 50% increase in overall DTSQ scores, from 30 to 45 ( $p < 0.005$ ), and the perceived frequency of hypoglycemia was significantly less when using FSL ( $p = 0.017$ ) compared to using SMBG. The DTSQ subscores for treatment flexibility and understanding of diabetes were also significantly

improved using the FreeStyle Libre system. Notably, the study also showed that higher daily scan frequencies were correlated with a decrease in HbA1c, where each additional scan was associated with a reduction of 0.036% in HbA1c ( $p = 0.032$ ).

The OPTIMISE program<sup>15</sup> demonstrated that using flash glucose monitoring as part of an integrated care approach for adults with T2DM and a mean age of 74 years was positively adopted, as it made the monitoring of their diabetes management outcomes easier in collaboration with healthcare teams. Notably, both flash glucose monitoring and videoconferencing were well accepted by this older group of individuals with T2DM, as part of a hybrid approach involving both telemedicine and home visits. Importantly, feasibility and acceptability of using CGM in very old adults up to 91 years of age has also been demonstrated<sup>16</sup>. Case reports<sup>17</sup> have also confirmed that use of the FreeStyle Libre system in an individual aged  $> 90$  years has been successful to assist in starting insulin treatment for T2DM, with positive outcomes for identifying and avoiding hypoglycemia, including severe episodes previously requiring hospitalization.

A real-world study investigating the benefits of using CGM for remote monitoring in combination with virtual clinics for people aged  $\geq 65$  years with T1DM during the COVID-19 pandemic<sup>18</sup>, found that participants were able to use CGM technology as part of a telemedicine program to increase TIR and reduce hyperglycemia without increasing hypoglycemia, which is comparable with pre-lockdown care.

Together, these studies show that older people living with diabetes can successfully use diabetes technology, including CGM devices, and that this is associated with significant increases in TIR, reduced TBR and reduced TAR, as well as improvements in QoL. Significantly, older people living with T2DM on intensive insulin therapy have reduced risk of hospital admission for DKA or severe hypoglycemia after starting to use CGM. Further studies on the efficacy, safety and cost-effectiveness of using CGM in this vulnerable group of people living with diabetes are certainly needed.

1. Sun H, et al. IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabetes Res Clin Pract.* 2020; 183: 109119. doi: 10.1016/j.diabres.2021.109119
2. Corriere M, et al. Epidemiology of Diabetes and Diabetes Complications in the Elderly: An Emerging Public Health Burden. *Curr Diabetes Rep.* 2013; 13: 805–813.
3. Munshi MN, et al. Frequent Hypoglycemia Among Elderly Patients With Poor Glycemic Control. *Arch Intern Med.* 2011; 171: 362–364.
4. Boureau A, et al. Nocturnal hypoglycemia is underdiagnosed in older people with insulin-treated type 2 diabetes: The HYPOAGE observational study. *J Am Geriatr Soc.* 2023; doi:10.1111/jgs.18341.
5. Bremer JP, et al. Hypoglycemia Unawareness in Older Compared With Middle-Aged Patients With Type 2 Diabetes. *Diabetes Care* 2009; 32: 1513–1517.
6. Meneilly GS, et al. Diabetes in the Elderly. *Diabetic Med* 1995; 12: 949–960.
7. Meneilly GS, et al. Diabetes in Elderly Adults. *Journals Gerontology Ser.* 2001; 56: M5–M13.
8. Schütt M, et al. Multiple complications and frequent severe hypoglycaemia in 'elderly' and 'old' patients with type 1 diabetes. *Diabetic Med* 2012; 29: e176–e179.
9. Singh S, et al. Defining "elderly" in clinical practice guidelines for pharmacotherapy. *Pharm Pract Granada* 2014; 12: 489–498.
10. Haak T, et al. Flash Glucose-Sensing Technology as a Replacement for Blood Glucose Monitoring for the Management of Insulin-Treated Type 2 Diabetes: a Multicenter, Open-Label Randomized Controlled Trial. *Diabetes Ther.* 2017; 8: 55–73.
11. Bao S, et al. Effectiveness of Continuous Glucose Monitoring in Older Adults with Type 2 Diabetes Treated with Basal Insulin. *Diabetes Technol Ther.* 2022; 24: 299–306.
12. Kröger J, et al. Three European Retrospective Real-World Chart Review Studies to Determine the Effectiveness of Flash Glucose Monitoring on HbA1c in Adults with Type 2 Diabetes. *Diabetes Ther.* 2020; 11: 279–291.
13. Guerci B, et al. Reduced acute diabetes events after FreeStyle Libre® system initiation in people 65 years or older with type 2 diabetes on intensive insulin therapy in France. *Diabetes Technology Ther.* 2023; 25: 384–394.
14. Huang E, et al. Association of FreeStyle Libre usage and treatment satisfaction among the elderly participants with type 2 diabetes. Poster #EP168, European Association for the Study of Diabetes, 59th Annual meeting 2023.
15. Ogrin R, et al. Older People With Type 2 Diabetes—Individualising Management With a Specialised Community Team (OPTIMISE): Perspectives of Participants on Care. *Clin Diabetes* 2021; 39: 397–410.
16. Zac-Varghese S, et al. Managing type 1 diabetes in frailty. *BMJ Case Rep.* 2022; 15, e253779.
17. Selvin E, et al. Glucose Patterns in Very Old Adults: A Pilot Study in a Community-Based Population. *Diabetes Technol Ther.* 2021; 23: 737–744.
18. Toschi E, et al. Use of telecommunication and diabetes-related technologies in older adults with Type 1 Diabetes during a time of sudden isolation. *JMIR Diabetes* 2022; 7: e38869. doi: 10.2196/38869.



Image for illustrative purposes only. Not real patient.

## Use of the FreeStyle Libre system can reduce severe hypoglycemia, workplace absenteeism and increase treatment satisfaction in adults with T1DM

This real-world observational study aimed to evaluate the impact of the first-generation 14-day FreeStyle Libre system (without alerts) on quality of life, severe hypoglycemia, work absenteeism and glycaemic outcomes over 24 months in adults with T1DM.

The FUTURE study included 1,905 people with T1DM in Belgium; of these, 16% had impaired awareness of hypoglycemia (IAH) and the remaining adults had normal awareness of hypoglycemia (NAH). General quality of life, diabetes distress, and HbA1c remained stable over 24 months, but treatment satisfaction significantly improved in both groups, by 3.1 points in the group with IAH and 2.3 points in the group with NAH ( $p < 0.001$ , in both cases). Hypoglycemia fear significantly improved in the IAH group only, from a score of 22.8 at baseline to 20.6 at 24 months ( $p = 0.002$ ). This group also showed a significant decline in work absenteeism and severe hypoglycemia: 36.4% of adults with IAH had an event 6 months before initiation of the FreeStyle Libre system compared with 16.0% during the last 6 months of follow-up.

There were similar findings for hypoglycemia hospitalization and hypoglycemia coma. Compared with people with NAH, people with IAH spent more time in hypoglycemia, but less time in hyperglycemia. The authors concluded that the FreeStyle Libre system is a valuable tool in long-term real-world clinical settings.

Charleer S, *et al.* Sustained impact of intermittently scanned continuous glucose monitoring on treatment satisfaction and severe hypoglycemia in adults with type 1 diabetes (FUTURE): An analysis in people with normal and impaired awareness of hypoglycemia. *Diabetes Technol Ther.* 2023;25(4):231-241. doi: 10.1089/dia.2022.0452.



Image for illustrative purposes only. Not real patient.

## Flash glucose monitoring over 24 weeks is associated with glycaemic improvements for adults with T1DM or T2DM with suboptimal glycaemic control

This real-world study investigated changes in glycaemic parameters among Europeans with diabetes not meeting glycaemic targets who started the FreeStyle Libre system.

De-identified data were obtained between 2014 and 2021 from 1,909 adults with T1DM and 1,813 with T2DM. Treatment regimens were; basal-bolus insulin ( $n = 1,499$ ); basal insulin ( $n = 189$ ), or non-insulin therapy ( $n = 125$ ). All included adults had used flash glucose monitoring uninterrupted for a 24-week period. Within each treatment group, subgroup analyses were performed in individuals with initial suboptimal glycaemic control, as indicated by  $< 70\%$  time in range (TIR, 3.9–10 mmol/L),  $> 25\%$  time above range (TAR,  $> 10$  mmol/L), or  $> 4\%$  time below range (TBR,  $< 3.9$  mmol/L).

The study revealed significant improvements in TIR, TAR, TBR and glycaemic variability, both for adults with T1DM and those with T2DM. Adults with T1DM and initially with

TIR  $< 70\%$  concurrently improved their TIR, TAR and TBR metrics after 24 weeks continuous use of flash glucose monitoring. This was also true for the adults with T2DM on basal-bolus insulin therapy. Adults with T2DM on basal insulin therapy or not on insulin therapy saw improvements in TIR, TAR and measures of average glucose, but not in TBR. Overall, these real-world data show that adults with T1DM or T2DM who have suboptimal glycaemic control on any therapy can achieve improved glycaemic control following 24 weeks of flash glucose monitoring use.

Lameijer A *et al.* Real-life 24-week changes in glycaemic parameters among European users of flash glucose monitoring with type 1 and 2 diabetes and different levels of glycaemic control. *Diabetes Res Clin Pract.* 2023;201:110735. doi:10.1016/j.diabres.2023.110735.

# The addition of flash glucose monitoring has the potential to transform diabetes self-management education and support in people with T2DM

This single-arm pilot study was undertaken in adults with T2DM to evaluate a new approach to patient education, a nondidactic 'discovery learning' program centred on flash glucose monitoring.

The AH-HA! Project included 35 adults, aged 21–75 years, with a T2DM duration of 1–5 years, not using insulin and with HbA1c  $\geq 8.0\%$ . Participants were initiated on the FreeStyle Libre system and completed five weekly group sessions of diabetes self-management education and support, which was personalised using specific concerns and questions arising from each individual's experience of flash glucose monitoring.

There were significant improvements in glycemic measures from baseline to month 3, both in terms of percentage time in range (TIR) 70–180 mg/dL (3.9–10.0 mmol/L), which increased from 55% to 74%, and percentage time above range (TAR)  $>180$  mg/dL (10.0 mmol/L), which decreased from 44% to 25% ( $p=0.01$ ). General well-being ( $p=0.04$ ) and healthy eating ( $p<0.001$ ) also significantly improved, while physical activity and diabetes distress were not significantly improved.



Image for illustrative purposes only. Not real patient.

The findings support a new role for diabetes self-management education and support programmes, specifically integrating flash glucose monitoring with a highly interactive and engaging patient-driven 'discovery learning' approach to education.

Polonsky WH, *et al.* The AH-HA! Project: Transforming group diabetes self-management education through the addition of flash glucose monitoring. *Diabetes Technol Ther.* 2023;25(3):194-200. doi: 10.1089/dia.2022.0419.

## Real-world evidence supports the use of flash glucose monitoring in adults with T2DM not on intensive insulin regimens

A retrospective review was conducted at a major tertiary hospital in Saudi Arabia to investigate the sustainability of flash glucose monitoring in T2DM patients not on intensive insulin regimen.

The study included 93 patients with T2DM with at least 12 months of continuous use of the FreeStyle Libre system. Various glycemic markers were assessed, including average glucose and time in range. Differences in markers of glycemic control derived from using the FreeStyle Libre system were also correlated with laboratory-derived HbA1c values.

Mean HbA1c values significantly decreased, from 8.3% before continued use of the FreeStyle Libre system, to 8.1% in the first 90 days and 7.9% in the last 90 days of device use, respectively ( $p<0.001$ , in both cases). Furthermore, for both 90-day time periods, there were significant positive correlations and linear regressions between laboratory-derived HbA1c and glucose monitoring index (GMI) values ( $p<0.001$ , in both cases).

These real-world data demonstrate that reductions in HbA1c for people with T2DM not on intensive insulin regimens are associated with starting flash glucose monitoring, and high levels of agreement between measured HbA1c and GMI values.

Al Hayek AA and Al Dawish MA. Use of flash glucose monitoring and glycemic control in patients with Type 2 Diabetes Mellitus not treated with an Intensive Insulin Regimen: 1-Year real-life retrospective cohort study. *Adv Ther.* 2023 Jun;40(6):2855-2868. doi: 10.1007/s12325-023-02508-y.

## FreeStyle Libre system is effective in preventing acute diabetes-related events in adults with T1DM, in addition to lowering HbA1c

Electronic health records from Eastern Finland between January 2015 and April 2020 were reviewed in conjunction with hospital admission and emergency service data to evaluate the frequency of severe hypoglycemia and diabetic ketoacidosis (DKA) before and after the start of the FreeStyle Libre system without alarm functions in people with T1DM.

642 patients with T1DM were identified who experienced severe hypoglycemic events during the study period. There was a significant decrease in the incidence of severe hypoglycemic events requiring emergency medical support or hospital admission, from 148 events (incidence rate 76 events/1000 person-years) before the start of flash glucose monitoring to 72 events (incidence rate 50 events/1000 person-years) following the start of device use ( $p=0.043$ ). A similar reduction was observed for the incidence rate of DKA: 15 versus 4 events/1000 person-years ( $p=0.002$ ), and there was also a significant change in mean HbA1c of  $-0.28\%$  ( $-3.1$  mmol/mol) between baseline and the last HbA1c measurement ( $p<0.001$ ).

The study indicates that, in addition to lowering HbA1c in people with T1DM, initiating the FreeStyle Libre system without alarms was effective in preventing acute diabetes-related events, such as hypoglycemia and DKA, requiring emergency medical support or hospital admission.

Mustonen J *et al.* The use of isCGM leads to marked reduction in severe hypoglycemia requiring emergency medical service or hospital admission and diabetic ketoacidosis in adult type 1 diabetes patients. *Acta Diabetol.* 2023;60(7):891-898. doi: 10.1007/s00592-023-02079-y.

# Experience with the FreeStyle Libre system is reflected in improved glycemic outcomes

This study in the Czech Republic used deidentified data extracted from 1,600 FreeStyle Libre system users, with  $\geq 36$  completed sensors between October 2018 and December 2021, to investigate the association between novel measures of adherence and improvements in metrics of glucose control.

'Experience' was defined by the number of sensors used (1–36 sensors) and the study defined four experience levels after initiating flash glucose monitoring: Start (sensors 1–3); Early (sensors 4–6); Middle (sensors 19–21); End (sensors 34–36). 'Adherence' was defined by the time taken between the end of one sensor ending and the start of the next sensor (gap time). Users were split into two adherence levels based on the mean gap time during the Start period: low ( $>24$  h,  $n=723$ ) and high ( $\leq 8$  h,  $n=877$ ).

The analysis showed that low-adherence users significantly reduced their sensor gap times, with 38.5% applying a new sensor within 24 h during sensors 4–6, rising to 65.0% by sensors 34–36 ( $p<0.001$ ). Importantly, improved adherence was associated with significantly increased time in range (mean +2.4%), reduced time above range (mean -3.1%), and reduced glucose variability ( $p<0.001$  in all cases).

The authors concluded that, with experience, FreeStyle Libre users became more adherent with sensor reapplication, and this was associated with beneficial effects on glycemic control.

Šoupal J *et al.* Low initial adherence with flash glucose monitoring is not a predictor of long-term glycemic outcomes: Longitudinal analysis of the association between experience, adherence, and glucose control for FreeStyle Libre users. *Diabetes Ther.* 2023;14(7):1231-1240. doi: 10.1007/s13300-023-01422-4.

# The FreeStyle Libre 3 system demonstrates accurate performance across the dynamic glycemic range over 14-days continuous use

This study was conducted at four sites in the USA and evaluated the performance of the FreeStyle Libre 3 system compared with paired venous plasma glucose reference readings for participants with T1DM or T2DM aged  $\geq 6$  years. Finger prick capillary blood glucose reference tests were used for children aged 4 and 5 years.

Adults participated in three in-clinic sessions, and pediatric patients (aged 4–17 years) participated in up to two in-clinic sessions, which were stratified to provide data across the 14-day wear period for the FreeStyle Libre 3 sensors.

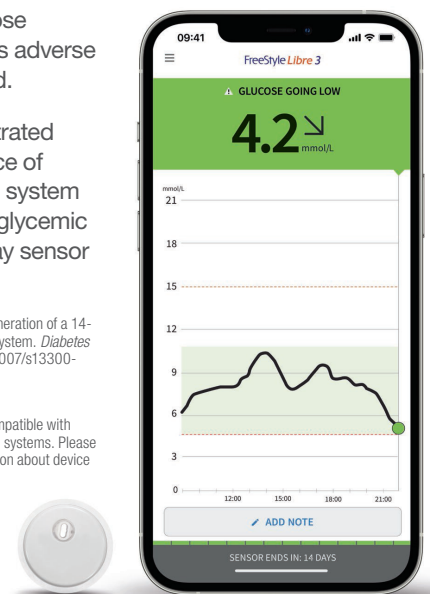
Data from 100 participants were included in the analysis, which showed that the mean absolute relative difference (MARD) between the FreeStyle Libre 3 system readings and paired reference values was 7.8%, with 93.4% of the CGM values being within  $\pm 20\%$  ( $\pm 20$  mg/dL) for participants aged  $\geq 6$  years, and with performance remaining stable over the 14-day wear period. Similarly, the MARD was 10.0% for participants aged 4–5 years, with 88.9% of the CGM values being within 20% (20 mg/dL) compared with a finger prick

capillary blood glucose reference. No serious adverse events were reported.

These data demonstrated accurate performance of the FreeStyle Libre 3 system across the dynamic glycemic range during a 14-day sensor wear period.

Alva S *et al.* Accuracy of the third generation of a 14-day continuous glucose monitoring system. *Diabetes Ther.* 2023;14(4):767-776. doi: 10.1007/s13300-023-01385-6.

The FreeStyle Libre 3 app is only compatible with certain mobile devices and operating systems. Please check our website for more information about device compatibility before using the app.



# Flash glucose monitoring reduces both impaired awareness of hypoglycemia and episodes of severe hypoglycemia amongst car drivers with T1DM

More insights from the ABCD FreeStyle Libre nationwide audit shows using the FreeStyle Libre system can restore awareness of hypoglycemia amongst car drivers.

The study examined paired baseline and follow-up data on 1,606 people with diabetes using the FreeStyle Libre system who had data recorded about their driving status from 102 UK specialist diabetes centres. At a mean follow-up of 6.9 months, the Gold score had improved (2.3 vs. 2.0;  $p<0.001$ ), and the number of drivers who experienced a severe hypoglycemia episode was significantly lower (12.1% vs. 2.7%,  $p<0.001$ ).

This study indicates that using the FreeStyle Libre system may improve impaired awareness of hypoglycaemia and reduce the number of people with T1DM with a driving licence experiencing a severe hypoglycaemic episode. This is an important outcome, since complete loss of hypoglycaemia awareness or more than one severe hypoglycemia event per year disqualifies people with T1DM from driving in the UK

Mark-Wagstaff C, *et al.* Intermittently scanned continuous glucose monitoring and hypoglycaemia awareness in drivers with diabetes: Insights from the Association of British Clinical Diabetologists Nationwide audit. *Diabetes Obes Metab.* 2023; doi: 10.1111/dom.15283.

# Flash glucose monitoring reduces severe hypoglycemia and improves hypoglycemia awareness and quality of life in adults with T1DM and recurrent hypoglycemia

This study in adults with T1DM and recurrent hypoglycemia who were treated with multiple daily injections aimed to evaluate the effectiveness of the FreeStyle Libre 2 system, with optional alarms, in preventing severe hypoglycemia and reducing hypoglycemia exposure.

The study was conducted at a single centre in Barcelona, Spain, and included 110 adults, with a mean age of 47.8 years. All adults who were started on the FreeStyle Libre 2 system between June 2020 and May 2021, as a consequence of impaired awareness of hypoglycemia (IAH) or recurrent hypoglycemia, were systematically included.

At 1-year follow-up, there was a significant decrease in severe hypoglycemia events, from 0.3 to 0.03 episodes/year ( $p < 0.001$ ). The proportions of individuals presenting with a severe hypoglycemia event or with IAH were also

significantly lower: 26.4% versus 2.9% ( $p < 0.001$ ) and 47.1% versus 25.9% ( $p = 0.002$ ), respectively. Furthermore, there were significant improvements in quality of life (QoL). Patients with an initial tight glycemic control (GMI  $< 7\%$  ( $< 53$  mmol/mol)) decreased time in hypoglycemia  $< 70$  mg/dl ( $< 3.9$  mmol/l) by  $-2.6\%$  ( $p = 0.027$ ) while patients with initial suboptimal glycemic control ( $\geq 7\%$  ( $\geq 53$  mmol/mol)) decreased hyperglycemia exposure by significantly increasing TIR ( $+4.9\%$ ;  $p = 0.005$ ).

These data demonstrated that starting the FreeStyle Libre 2 system, with optional alarms, decreased the rates of severe hypoglycemia and improved hypoglycemia awareness, with associated increases in QoL.

Contreras M, et al. Effectiveness of flash glucose monitoring in patients with type 1 diabetes and recurrent hypoglycemia between early and late stages after flash glucose monitoring initiation. *J Diabetes Complications*. 2023;37(8):108560. doi: 10.1016/j.jdiacomp.2023.108560.

## Adults with T1DM perceive diabetes technology as important for managing glycaemia and emotional well-being

'Empowering Us' was a community-led survey conducted in Australia to identify priorities for optimal use of advanced glucose management technologies in adults with T1DM.

A total of 3,380 current or past users of insulin pump therapy (IPT), real-time CGM or flash glucose monitoring, completed a 30-question online survey between November 2021 and January 2022. Participants had a mean age of 45 years and mean duration of T1DM of 20 years.

Overall, 54%, 81%, and 55% of participants reported experience with IPT, real-time CGM, or flash glucose monitoring, respectively. Most respondents considered diabetes technology as 'extremely important' for maintaining target glucose levels (98%) and for reducing hypoglycemia severity and frequency (93%). Moreover, more-than 87% of respondents considered that use of real-time CGM or flash glucose monitoring contributed positively to their emotional well-being, and this was associated with device effectiveness in maintaining glucose time in range, as well as comfort and convenience. Ease of use and reliability were also identified as important attributes. Barriers to optimal use of advanced glucose monitoring systems included affordability and insufficient support to enable informed choices about device suitability.

These survey data demonstrate that sensor-based glucose monitoring systems are perceived as important, both for managing glycaemia and emotional well-being, and highlight areas of access and support for the future.

Read M, et al. "Empowering Us": A community-led survey of real-world perspectives of adults with type 1 diabetes using insulin pumps and continuous glucose monitoring to manage their glucose levels. *Diabetes Res Clin Pract*. 2023; 202:110830. doi: 10.1016/j.diabetes.2023.110830.



Image for illustrative purposes only. Not real patient.

# Continuous glucose monitoring use over 8 years is associated with improved glycemic outcomes in adults with T1DM

**This single-centre study in adults with T1DM evaluated change in mean HbA1c following initiation of CGM between January 2014 and December 2021 to determine the association between diabetes technology and glycemic outcomes.**

A total of 15,903 clinic visits over 8 years (mean 1,988 patients/year; 4,174 unique patients; 52.7% female; 80.0% Non-Hispanic White) were included in the analysis. Diabetes technology use was defined as the use of continuous glucose monitoring (CGM) systems without an automated insulin delivery (AID) system or use of an AID system.

During the study period from 2014 to 2021, use of CGM systems increased from 27% of adults with T1DM to 44%

( $p < 0.001$ ). Use of CGM was associated with a lower mean HbA1c (-0.54%) compared to adults who did not use diabetes technology ( $p < 0.001$ ). Similarly, a greater proportion of adults with T1DM who used CGM achieved an HbA1c  $< 7.0\%$  compared to those who did not use diabetes technology ( $p < 0.001$ ) for every year from 2014 to 2021. This differential in adults with T1DM achieving an HbA1c  $< 7.0\%$  increased over time, such that in 2021, 44% of CGM users achieved an HbA1c  $< 7.0\%$ , compared to only 15% of non-technology users ( $p < 0.001$ ). These outcomes support the clinical recommendations that CGM systems should be initiated from the onset of T1DM.

Karakus KE, *et al.* Association Between Diabetes Technology Use and Glycemic Outcomes in Adults With Type 1 Diabetes Over a Decade. *Diabetes Care.* 2023; 46(9):1646-1651.

# Self-directed online onboarding or face-to-face initiation of the FreeStyle Libre systems are equally effective for people with diabetes

**This audit at the Leicester General Hospital diabetes centre in the UK evaluated glycemic outcomes in adults with diabetes who initiated the FreeStyle Libre system either face-to-face with diabetes healthcare professionals or via online video remote onboarding.**

A total of 935 people living with diabetes were included in the audit, all of whom started using FreeStyle Libre systems between January 2019 and April 2022. Ethnicity and measures of social deprivation were also audited. All participants had  $\geq 90$  days of data in LibreView with  $> 70\%$  data completion, and 80% had started the FreeStyle Libre 2 sensor. Amongst the study group, 413 (44%) had participated in face-to-face onboarding and 522 (56%) had had undertaken online video onboarding.

Glucose metrics from LibreView reports\* included percentage time in range 70-180 mg/dL (3.9-10.0 mmol/L), along with previous 90-day averages to estimate engagement with

the FreeStyle Libre systems. Together, these data showed that there were no significant differences in glycemic or engagement indices between onboarding methods. Ethnicity was not correlated to onboarding outcomes, but there was a significant difference in engagement metrics between the most deprived and least deprived groups included in the analysis. Specifically, the most deprived group had a significantly lower percentage active time ( $p = 0.002$ ) than the least deprived group.

This real-world audit reveals that remote initiation of flash glucose monitoring via online videos can be used to achieve comparable glucometric and engagement profiles as with face-to-face initiation.

Kingsnorth AP, *et al.* Comparing glucose outcomes following face-to-face and remote initiation of flash glucose monitoring in people living with diabetes. *J Diabetes Sci Technol.* 2023;17(4):887-894.

\*The LibreView data management software is intended for use both by patients and healthcare professionals to assist people with diabetes and their healthcare professionals in the review, analysis and evaluation of historical glucose device data to support effective diabetes management. The LibreView software is not intended to provide treatment decisions or to be used as a substitute for professional healthcare advice.



Image for illustrative purposes only. Not real patient.

# Frequent glucose monitoring and the use of CGM devices are associated with fewer diabetes complications in people with T1DM or T2DM in Saudi Arabia

This study was performed at King Abdulaziz University Hospital between June and December 2022, and included adults with T1DM or T2DM who completed an online questionnaire enquiring about glucose monitoring and diabetes complications.

A total of 206 adults with diabetes, with a mean age 41.2 years, participated in the study; 53.4% had T1DM. Most participants reported that they monitored their glucose levels (85.4%), with the majority (65.3%) reporting that they monitored their glucose levels at least once daily. Participants who monitored their glucose levels more frequently had significantly fewer complications, including cardiovascular disease, neuropathy, retinopathy, nephropathy or hypertension ( $p=0.002$ ). Users of CGM (23.3% of participants) reported a significantly lower mean number of complications than non-CGM users ( $p=0.002$ ), suggesting that this method was the most impactful method of glucose monitoring.

Overall, the data demonstrated that frequent glucose monitoring and the use of CGM devices were associated with a decreased number of diabetes complications and the authors recommended that physicians encourage CGM use amongst people with diabetes.

Alkhatieb MT, *et al.* The impact of frequent glucose monitoring on the prevalence of complications among patients with diabetes in Saudi Arabia. *Cureus*. 2023;15(5):e39796. doi: 10.7759/cureus.39796.

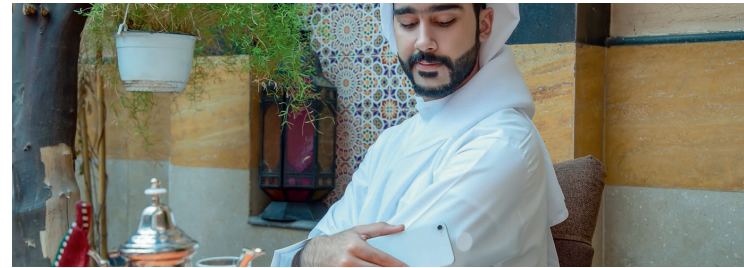


Image for illustrative purposes only. Not real patient.

## Use of the FreeStyle Libre system in adults with T2DM on insulin therapy in Sweden is associated with lower HbA1c and reduced hospitalisation

This study investigated whether using the FreeStyle Libre system compared to self-monitoring of blood glucose (SMBG) in adults with T2DM, treated with insulin, was associated with changes in HbA1c or rates of hospital admission.

Using linked-analysis to of the Swedish National Diabetes Register (NDR) and the Swedish Prescribed Drug Register (SPDR), this study identified 5,168 adults aged  $\geq 18$  yrs with T2DM on either multiple daily injections (MDI) or on basal insulin therapy, who started the FreeStyle Libre system after June 2017. The Swedish National Patient Register (NPR) was used to assess hospital admission rates. Outcomes for this group were compared to a matched control group of 77,008 adults with T2DM using SMBG.

Compared to SMBG controls, adults with T2DM on MDI ( $n=2,876$ ) using the Freestyle Libre system achieved a mean reduction in HbA1c of  $-0.34\%$  ( $-3.7$  mmol/mol) at 6 months, maintained for 2 years. A similar pattern of lowered HbA1c ( $-0.32\%$ ;  $-3.5$  mmol/mol) was seen over 2 years in the basal insulin cohort. Adults with T2DM using the FreeStyle Libre system had a lower relative risk (RR) of hospital admission for any reason, compared to SMBG controls, whether they were treated with MDI ( $RR=0.84$ ;  $p<0.001$ ) or basal insulin ( $RR=0.76$ ;  $p<0.001$ ).

These study outcomes show that Swedish adults with T2DM on any insulin treatment who initiate the FreeStyle Libre system have significantly reduced HbA1c and lower rates of hospital admission, compared to matched controls using SMBG only.

Nathanson D, *et al.* Intermittently-scanned CGM is associated with lower HbA1c and reduced hospital admissions for adults with T2DM on insulin therapy in Sweden: a retrospective controlled study. Short Oral #821, European Association for the Study of Diabetes, 59th Annual meeting 2023.

## Flash glucose monitoring is associated with reduced hospitalisation for adults with T1DM in Sweden

This study investigated how using the FreeStyle Libre system compared to self-monitoring of blood glucose (SMBG) in adults with T1DM impacted the rates of hospital admission for acute events, such as severe hypoglycemia or diabetic ketoacidosis (DKA), or for any reason.

This retrospective controlled cohort study used the Swedish National Diabetes Register (NDR) to identify adults aged  $\geq 18$  years with T1DM who started using the FreeStyle Libre system after June 2017. By linking the deidentified data to hospital inpatient records in the National Patient Register (NPR), the study assessed hospital admission rates for hypoglycemia, DKA and overall hospital admissions for people with T1DM after starting the FreeStyle Libre system ( $n=11,822$ ), compared to a matched control group of adults with T1DM using SMBG ( $n=3,007$ ).

Compared to the control group, adults with T1DM using the FreeStyle Libre system reduced relative risk (RR) for hospital admission for hypoglycemia ( $RR=0.32$ ;  $0.14, 0.74$ ) and diabetic ketoacidosis (DKA) ( $RR=0.55$ ;  $0.35, 0.87$ ). Hospitalization for any reason was also reduced for FreeStyle Libre users ( $RR=0.32$ ;  $0.29, 0.35$ ).

This retrospective controlled study shows that adults in Sweden with T1DM who initiate flash glucose monitoring with the FreeStyle Libre system have significantly reduced risk for hospitalisation for hypoglycaemia, DKA and hospital admission for any reason.

Eeg-Olofsson K, *et al.* Retrospective controlled study shows intermittently-scanned CGM is associated with lower HbA1c and reduced hospitalisation for diabetes events in adults with T1DM in Sweden. Short Oral #818, European Association for the Study of Diabetes, 59th Annual meeting 2023.



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