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FreeStyle Libre

THE sensor report

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WELCOME TO

THE SENSOR REPORT, ISSUE 4, 2025

Since the introduction of continuous glucose monitoring (CGM) devices, attention has been focused on metabolic changes that indicate improved glucose control based on the established markers of glycemic management, such as glycated hemoglobin (HbA1c) and episodes of diabetic ketoacidosis (DKA) or severe hypoglycemic events (SHEs). It is now accepted that each of these health status indicators is significantly improved by the application of CGM technology, compared to standard blood glucose monitoring (BGM), both in T1DM and in T2DM.[1,2]

The focus of clinical research has moved onto the wider impact of hyperglycemic and hypoglycemia for people living with diabetes. Landmark studies have shown that more-intensive glucose control and reduced HbA1c for people with T1DM is associated with a 42% reduced risk of any cardiovascular event and a 57% risk reduction of death from cardiovascular disease (CVD).[3] Similarly, for people with T2DM, a 1% reduction in HbA1c is associated with a 15% reduction in risk of myocardial infarction (MI) and a 21% reduction in risk of diabetes-related death.[4] To date, the use of CGM has been directly associated with reduced risks for acute diabetes events (ADEs) such as DKA and SHEs,[5] but the link between CGM and reduced long-term cardiovascular disease (CVD) has continued to be based on the impact on HbA1c.

In this issue of the *Sensor Report*, we cover several important clinical observations that provide a direct link between the application of CGM technology and prevention of cardiovascular disease for people with diabetes. In a series of groundbreaking analyses, the use of the FreeStyle Libre systems has been shown to be associated with a significant relative reduction in rates of hospitalization for CVD-events, including a 75% fall in admissions for heart failure, a 52% reduction in stroke admissions, as well as 41% and 36% fewer admission for atrial fibrillation and acute myocardial infarction (AMI), respectively.[6] These outcomes were evident over a 24 month follow-up period and were also associated with a –0.30% (–3.3 mmol/mol) lowering of HbA1c. However, the relatively brief two-year intervention period and the modest reduction in HbA1c prompted the clinical research team to hypothesize that the reductions in CVD were not a consequence of improved long-term glycemia, rather that the avoidance of SHEs for FreeStyle Libre systems users was a critical component of improved cardiovascular health.

The connection between SHEs and CVD events was investigated using linked data from the Swedish National Diabetes Register (NDR) and National Patient Register (NPR). Using a composite outcome of non-fatal acute MI, coronary artery disease, non-fatal stroke, heart failure, atrial fibrillation and cardiovascular death, the analysis compared the rate of CVD complications over a two-year period following a prior SHE for FreeStyle Libre systems users with T1DM versus a matched control group of BGM users.[7] The outcomes were striking. Overall, the rate of hospitalizations for CVD complications was more than doubled in the cohort of adults in with prior SHE compared to those without prior SHE. However, the rate of CVD hospitalizations among individuals with a prior SHE was reduced by 78% for FreeStyle Libre systems users compared to BGM users ($p<0.001$). Similarly, among adults with T1DM without any prior SHE, the CVD hospitalization rate for FreeStyle Libre systems users was reduced by 77% compared to BGM users ($p<0.001$). These outcomes are discussed in more detail in our Feature Article and support the hypothesis that previous experience of SHE is a component of significantly increased risk of CVD complications for adults with T1DM.

In addition to the outcomes reported in the feature article, recent studies have reported that CVD events related to acute MI, unstable angina or ischemic stroke in a large population of individuals with T2DM are reduced by 16% over 18 months following initiation of CGM devices,[8] with a 21% fall in all-cause mortality. In this context, a retrospective review of the outcomes from the RESCUE and FUTURE studies in T1DM has revealed that use of CGM technology and a 10% increase in time in tight range (TITR) was associated with by a 38% reduced risk for cerebrovascular events.[9] These studies are reviewed in this issue of the Sensor Report.

Significant research reporting CGM outcomes from the American Diabetes association 2025 Scientific Sessions is also reviewed in this issue of the *Sensor Report*, along with notable studies recently published in the peer-reviewed literature.

IN THIS ISSUE

1. Champakanath A, *et al.* Continuous Glucose Monitoring Initiation Within First Year of Type 1 Diabetes Diagnosis Is Associated With Improved Glycemic Outcomes: 7-Year Follow-Up Study. *Diabetes Care* 2022; 45: 750–753. [https://pubmed.ncbi.nlm.nih.gov/35018417/]

2. Ajjan RA, *et al.* Continuous glucose monitoring for the routine care of type 2 diabetes mellitus. *Nat Rev Endocrinol* 2024; 20: 426–440. [https://pubmed.ncbi.nlm.nih.gov/38589493/]

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5. Riveline J-P, *et al.* Reduced Rate of Acute Diabetes Events with Flash Glucose Monitoring Is Sustained for 2 Years After Initiation: Extended Outcomes from the RELIEF Study. *Diabetes Technol Ther.* 2022; 24: 611–618. [https://pubmed.ncbi.nlm.nih.gov/35604792/]

6. Eeg-Olofsson K, *et al.* Initiation of intermittently-scanned continuous glucose monitoring is associated with reduced hospitalization for acute diabetes events and cardiovascular complications in adults with type 1 diabetes. *Diabetes Care* 2024; 47:2164–2171. [https://pubmed.ncbi.nlm.nih.gov/39316385/]

7. Eeg-Olofsson K, *et al.* Severe hypoglycaemia is associated with increased risk of adverse cardiovascular complications in adults with type 1 diabetes: risk mitigation using intermittently scanned continuous glucose monitoring. *Diabetologia* 2025. doi:10.1007/s00125-025-06438-y. [https://pubmed.ncbi.nlm.nih.gov/40272529/]

8. Reaven PD, *et al.* Initiation of Continuous Glucose Monitoring and Mortality in Type 2 Diabetes. *Diabetes Technol Ther* 2025. doi:10.1089/dia.2025.0227. [https://pubmed.ncbi.nlm.nih.gov/40432529/]

9. Meulemeester JD, *et al.* The association of chronic complications with time in tight range and time in range in people with type 1 diabetes: a retrospective cross-sectional real-world study. *Diabetologia* 2024; 67: 1527–1535. [https://pubmed.ncbi.nlm.nih.gov/38787436/]

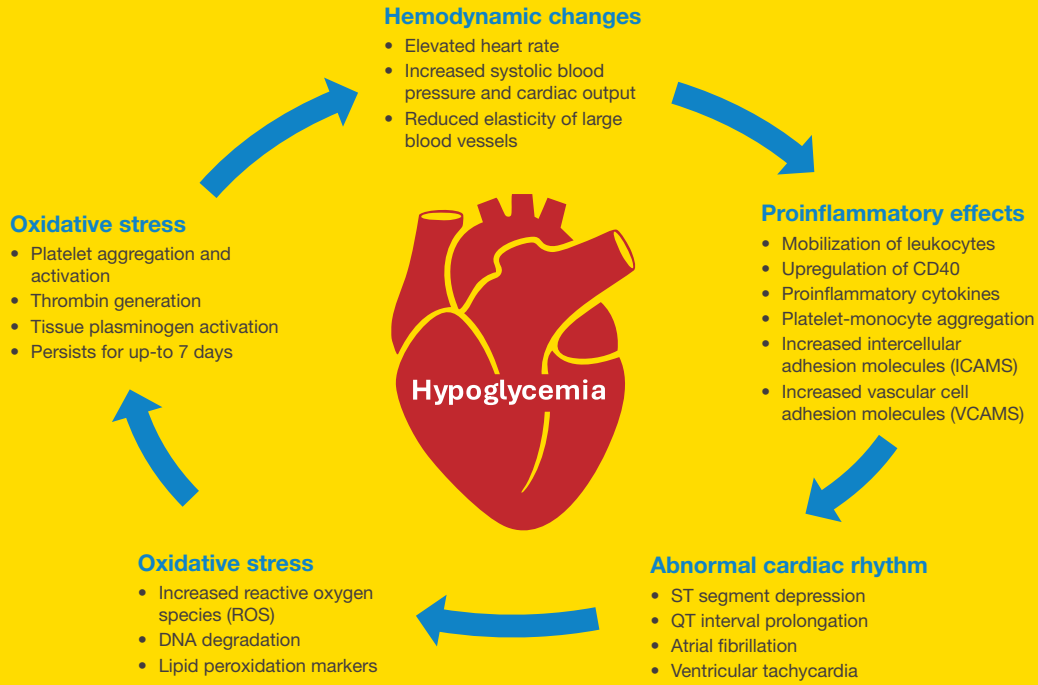
Severe hypoglycemia is associated with increased risk of cardiovascular complications in adults with T1DM, which is reduced for FreeStyle Libre systems users

The landmark Diabetes Control and Complications Trial (DCCT) and the Epidemiology of Diabetes Interventions and Complications (EDIC) Study have shown that more-intensive glucose control for people with T1DM is associated with a 42% reduced risk of any cardiovascular event and a 57% risk reduction of death from cardiovascular disease (CVD),[1] over a mean 6.5 years. Data from the Swedish National Diabetes Register (NDR), linked with hospital admissions data from the Swedish National Patient Register (NPR), have shown that, compared to a matched cohort of individuals using blood-glucose meters (BGM), adults with T1DM using the FreeStyle Libre systems have a significant relative reduction in rates of hospitalization for CVD-events, including a 75% fall in admissions for heart failure, a 52% reduction in stroke admissions, as well as 41% and 36% fewer admission for atrial fibrillation and acute myocardial infarction (AMI), respectively.[2] These outcomes were evident over a 24 month follow-up period. These striking reductions in CVD-events for FreeStyle Libre users with T1DM were associated with an HbA1c reduction of about 0.3%[2] but, considering the short observation period and the modest difference in HbA1c, it did not seem reasonable to assume that the reductions in CVD events was a consequence of improved glycemic management.

Investigating the role of hypoglycemia in cardiovascular events in T1DM

An additional observation from the combined NDR and NPR data was that adults with T1DM using the FreeStyle Libre systems had a 68% reduced rate of hospital admissions for severe hypoglycemia events (SHEs).[2] An association between SHEs and an increased risk of CVD complications has been reported in people with T1DM,[3] and SHEs are independently associated with atherosclerosis, increased risk of CVD events and all-cause mortality.[4–6] An important strand of observations in this context is that acute or recurrent hypoglycemia episodes are known to induce proinflammatory cytokines, mobilization of inflammatory leukocytes, oxidative stress, increased platelet reactivity and markers of vascular endothelial stress, both in people with or without T1DM.[7–11] These are summarized in Figure 1. Acute hypoglycemia also increases heart rate, systolic blood pressure and blood flow,[12] which are associated with risk of CVD. Prior SHE may also be a marker for increased frequency of non-severe hypoglycemia, which has a cumulative effect on cardiac structures, since hypoglycemia is implicated in cardiac arrythmias in T1DM.[13–15]

Figure 1. The impact of hypoglycemia on cardiovascular function and risk of CVD[1–10]



1. Lung TWC, *et al.* Severe Hypoglycemia and Mortality After Cardiovascular Events for Type 1 Diabetic Patients in Sweden. *Diabetes Care* 2014; 37: 2974–81. [https://pubmed.ncbi.nlm.nih.gov/25092684/]

2. Giménez M, *et al.* Repeated Episodes of Hypoglycemia as a Potential Aggravating Factor for Preclinical Atherosclerosis in Subjects With Type 1 Diabetes. *Diabetes Care* 2011; 34: 198–203. [https://pubmed.ncbi.nlm.nih.gov/20929996/]

3. Wright RJ, *et al.* Effects of Acute Insulin-Induced Hypoglycemia on Indices of Inflammation. *Diabetes Care* 2010; 33: 1591–7. [https://pubmed.ncbi.nlm.nih.gov/20587725/]

4. Joy NG, *et al.* Effects of Acute Hypoglycemia on Inflammatory and Pro-atherothrombotic Biomarkers in Individuals With Type 1 Diabetes and Healthy Individuals. *Diabetes Care* 2010; 33: 1529–35. [https://pubmed.ncbi.nlm.nih.gov/20587723/]

5. Iqbal A, *et al.* Prolonged Inflammatory Response Post-Hypoglycemia: Mechanistic Insights Into the Relationship Between Low Glucose and Cardiovascular Risk. *Diabetes* 2022; 71: 2483–5. [https://pubmed.ncbi.nlm.nih.gov/36409790/]

6. Ratter JM, *et al.* Hypoglycaemia induces recruitment of non-classical monocytes and cytotoxic lymphocyte subsets in type 1 diabetes. *Diabetologia* 2018; 61: 2069–71. [https://pubmed.ncbi.nlm.nih.gov/29982873/]

7. Ratter JM, *et al.* Proinflammatory Effects of Hypoglycemia in Humans With or Without Diabetes. *Diabetes* 2017; 66: 1052–61. [https://pubmed.ncbi.nlm.nih.gov/28115398/]

8. Frier BM, *et al.* Hypoglycemia and Cardiovascular Risks. *Diabetes Care* 2011; 34: S132–7. [https://pubmed.ncbi.nlm.nih.gov/21525444/]

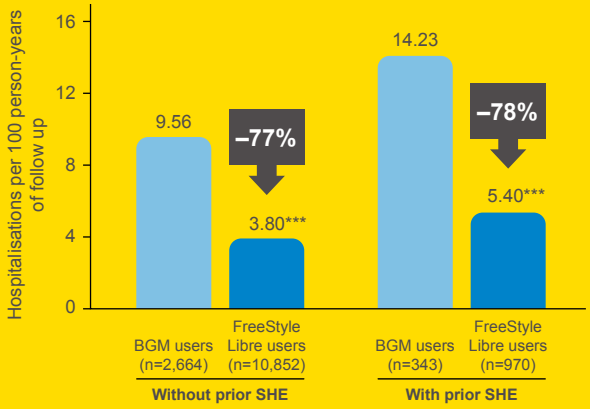
9. Bolognesi R, *et al.* Marked sinus bradycardia and QT prolongation in a diabetic patient with severe hypoglycemia. *J Diabetes Complicat* 2011; 25: 349–51. [https://pubmed.ncbi.nlm.nih.gov/21429766/]

10. Andersen A, *et al.* Hypoglycaemia and cardiac arrhythmias in diabetes. *Ther Adv Endocrinol Metab* 2020; 11: 2042018820911803. [https://pubmed.ncbi.nlm.nih.gov/32489579/]

Investigating the connection between SHEs and CVD events was possible using linked data from the NDR and NPR to examine the association between prior SHE in adults with T1DM and hospital admissions for non-fatal CVD complications and CVD-related death. For this study, a 6-point composite of non-fatal AMI, coronary artery disease (CAD), non-fatal stroke, heart failure (HF), atrial fibrillation and cardiovascular death, was used as the primary cause of CVD hospitalization in each case. This analysis compared the rate of CVD complications over a two-year period following a prior SHE for FreeStyle Libre systems users with T1DM versus a matched control group of BGM users.[16] The study identified 14,829 adults with T1DM with up to two years of follow-up, of whom 1,313 had experienced a previous SHE. Overall, the rate of hospitalizations for CVD complications was more than doubled in the cohort of adults with prior SHE (relative rate [RR] =2.06 [95% CI;1.48-2.85]) compared to those without prior SHE.

However, the frequency of CVD hospitalizations in individuals with a prior SHE was significantly lower for FreeStyle Libre systems users compared to BGM users (5.40 versus 14.23 per 100 person-years of follow-up), a 78% relative reduction in rates of CVD complications for FreeStyle Libre users ($p<0.001$), after adjustment for confounders (Fig. 1). When the two-year follow-up rate of CVD events was examined for adults with T1DM without any prior SHE, the hospitalization rate for FreeStyle Libre systems users was reduced by 77% compared to BGM users (3.30 versus 9.56 per 100 person-years of follow-up; $p<0.001$).

Figure 2. CVD complications in adults with T1DM with or without previous SHE are reduced for FreeStyle Libre users



*** p<0.001. T1DM
BGM, blood glucose monitoring; CVD, cardiovascular disease; SHE, severe hypoglycemic event; T1DM, type 1 diabetes mellitus

Eeg-Olofsson K, et al. Severe hypoglycaemia is associated with increased risk of adverse cardiovascular complications in adults with type 1 diabetes: risk mitigation using intermittently scanned continuous glucose monitoring. *Diabetologia* 68,1647–1656 (2025). [https://pubmed.ncbi.nlm.nih.gov/40272529/]

These outcomes clearly support the hypothesis that previous experience of at least one SHE is an important biomarker for significantly increased risk of CVD complications for adults with T1DM, approximately doubling the likelihood of hospitalization for non-fatal AMI, CAD, stroke, HF, atrial fibrillation and cardiovascular death.[16] Critically, use of the FreeStyle Libre systems for adults with T1DM can reduce the occurrence of these CVD events by more than 75%, in this higher-risk group of individuals with a prior SHE, and in the group with no previous SHE on record (Fig 2). These observations support and extend the outcomes showing that FreeStyle Libre systems users with T1DM have a significant relative reduction in rates of hospital admissions for cardiovascular complications of T1DM, compared to a matched BGM control group.[2] The role of hypoglycemia in the risks for hospital admission for CVD is now clearly identified and further research will provide additional detail on the possible mechanisms.

1. Nathan DM, *et al.* Intensive Diabetes Treatment and Cardiovascular Disease in Patients with Type 1 Diabetes. *N Engl J Med* 2005; 353: 2643–2653. [https://pubmed.ncbi.nlm.nih.gov/16371630/]

2. Eeg-Olofsson K, *et al.* Initiation of intermittently-scanned continuous glucose monitoring is associated with reduced hospitalization for acute diabetes events and cardiovascular complications in adults with type 1 diabetes. *Diabetes Care* 2024; 47: 2164–2171 [https://pubmed.ncbi.nlm.nih.gov/39316385/]

3. Lung TWC, *et al.* Severe Hypoglycemia and Mortality After Cardiovascular Events for Type 1 Diabetic Patients in Sweden. *Diabetes Care* 2014; 37: 2974–2981. [https://pubmed.ncbi.nlm.nih.gov/25092684/]

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6. The International Hypoglycaemia Study group, Amiel SA, *et al.* Hypoglycaemia, cardiovascular disease, and mortality in diabetes: epidemiology, pathogenesis, and management. *Lancet Diabetes Endocrinol* 2019; 7: 385–396. [https://pubmed.ncbi.nlm.nih.gov/30926258/]

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8. Joy NG, *et al.* Effects of Acute Hypoglycemia on Inflammatory and Pro-atherothrombotic Biomarkers in Individuals With Type 1 Diabetes and Healthy Individuals. *Diabetes Care* 2010; 33: 1529–1535. [https://pubmed.ncbi.nlm.nih.gov/20587723/]

9. Iqbal A, *et al.* Prolonged Inflammatory Response Post-Hypoglycemia: Mechanistic Insights Into the Relationship Between Low Glucose and Cardiovascular Risk. *Diabetes* 2022; 71: 2483–2485. [https://pubmed.ncbi.nlm.nih.gov/36409790/]

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11. Ratter JM, *et al.* Proinflammatory Effects of Hypoglycemia in Humans With or Without Diabetes. *Diabetes* 2017; 66: 1052–1061. [https://pubmed.ncbi.nlm.nih.gov/28115398/]

12. Frier BM, *et al.* Hypoglycemia and Cardiovascular Risks. *Diabetes Care* 2011; 34: S132–S137. [https://pubmed.ncbi.nlm.nih.gov/21525444/]

13. Gill GV, *et al.* Cardiac arrhythmia and nocturnal hypoglycaemia in type 1 diabetes—the 'dead in bed' syndrome revisited. *Diabetologia* 2009; 52: 42–45. [https://pubmed.ncbi.nlm.nih.gov/18972096/]

14. Bolognesi R, *et al.* Marked sinus bradycardia and QT prolongation in a diabetic patient with severe hypoglycemia. *J Diabetes Complicat* 2011; 25: 349–351. [https://pubmed.ncbi.nlm.nih.gov/21429766/]

15. Andersen A, *et al.* Hypoglycaemia and cardiac arrhythmias in diabetes. *Ther Adv Endocrinol Metab* 2020; 11: 2042018820911803. [https://pubmed.ncbi.nlm.nih.gov/32489579/]

16. Eeg-Olofsson K, *et al.* Severe hypoglycaemia is associated with increased risk of adverse cardiovascular complications in adults with type 1 diabetes: risk mitigation using intermittently scanned continuous glucose monitoring. *Diabetologia* 2025. DOI:10.1007/s00125-025-06438-y. [https://pubmed.ncbi.nlm.nih.gov/40272529/]

Professor Ramzi Ajjan provides an expert commentary on the use of CGM to understand and combat cardiovascular disease (CVD) in diabetes

Significant evidence is now emerging that using CGM and CGM metrics is associated with significant reductions in the rate of cardiovascular complications of diabetes, including heart failure, acute myocardial infarction, stroke, atrial fibrillation and cardiovascular mortality. These benefits can be linked to reduced hypoglycemia, increased time in range and reduced glycemic variability.

In this expert commentary, Dr Ramzi Ajjan, Professor of Metabolic Medicine at Leeds University and Leeds Teaching Hospitals Trust discusses how the application of CGM is helping people with diabetes to avoid CVD complications of T1DM or T2DM and the possible mechanisms involved.

Simply scan the QR code or use the link below to access this insightful interview.

[https://www.youtube.com/watch?v=31XVa6nHjjQ]

The synergistic impact of GLP-1 agonists with CGM technology in adults with T2DM

The separate glycemic benefits of using GLP-1 agonists or CGM devices for use in people with T2DM are well established. In this retrospective cohort study of electronic health record data from three healthcare centers, the impact of using them together in T2DM was investigated.

Overall, 4,110 adults with T2DM were included in the study, with HbA1c being compared before and after initiation of GLP-1 agonist, and following combination of GLP-1 agonist therapy with a CGM system. Starting a GLP-1 agonist led to a 0.6% (6.5 mmol/mol) reduction in mean HbA1c ($p<0.001$), with a 16% increase in the proportion of people achieving an HbA1c <7.0% (53 mmol/mol; $p < 0.001$), 12 months following GLP-1 initiation.

The combination of a GLP-1 agonist with a CGM system led to a greater decrease in HbA1c from baseline to 12 months (-0.9% [-9.9 mmol/mol] vs -0.4% [-4.4 mmol/mol], difference-in-difference = 0.5% [5.5 mmol/mol], $p=0.001$), compared to use of a GLP-1 agonist only.

The combined impact of providing access to CGM technology for people with T2DM on GLP-1 agonist therapy is further evidence for wider use of CGM for people with T2DM on non-insulin therapies. Not only are CGM devices associated with improvements in glycemia compared to using SMBG, they can synergize with glucose-lowering agents to further reduce HbA1c.

Thapa S, *et al.* HbA1c Improvement with the Addition of Continuous Glucose Monitoring to GLP-1 Agonist Therapy in People with Type 2 Diabetes. American Diabetes Association 85th Scientific Sessions, 1002-P

CGM combined with digital diabetes education and support can drive improvements in glycemia for adults with T2DM not on intensive therapy

The aim of this study was to establish whether engagement with a digital diabetes self-management and education support (DSMES) program in combination with use of a CGM system is associated with better clinical outcomes for adults with T2DM and suboptimal glycemia.

Individuals with T2DM and HbA1c ≥8.0% (≥64 mmol/mol) not on intensive insulin therapy were enrolled in a digital DSMES + CGM program (n=42) or continued on usual care (n=49) for 6 months. For participants in the digital DSMES + CGM group, a standardized total engagement score was calculated based on the number of interactions with DSMES app features.

Users with average total engagement scorer recorded a 1.08% (11.8 mmol/mol) decrease in HbA1c ($p< 0.001$) from baseline to 6 months, as well as a 16.5% increase in time in range (TIR) 70-180 mg/dL (3.9–10.0 mmol/L) ($p=0.001$) and a 16.6% decrease in time above range (TAR) >180 mg/dL (>10.0 mmol/L) ($p = 0.002$). Participants with higher levels of total engagement experienced a 1.71% (18.7 mmol/mol) decrease in HbA1c ($p < 0.001$), a 32.9% increase in TIR ($p < 0.001$), and a 32.9% decrease in TAR ($p < 0.001$), from baseline to 6 months. Participants with lower levels of total engagement experienced no significant changes in glycemic metrics from baseline to 6 months.

Naqvi JB, *et al.* Higher Engagement with a Digital DSMES + CGM Program Is Associated with More Robust Improvements in Glycemic Control. American Diabetes Association 85th Scientific Sessions, 157-OR

Using CGM for people with T2DM not on insulin is a cost effective intervention for users on diverse healthcare plans

Outcomes studies have confirmed that using CGM in the care of people with T2DM using non-insulin therapies, can reduce HbA1c and lower the risk of acute diabetes events (ADEs), such as severe hypoglycemic episodes (SHEs) and diabetic ketoacidosis (DKA), compared with self-monitoring of blood glucose (SMBG). In the United States, Medicare and some commercial healthcare insurance plans currently reimburse CGM only for people with diabetes who are on insulin. In two studies, the cost-impact of CGM reimbursement for people with T2DM not on insulin was investigated.

In the first study,[1] the budget impact was estimated for the 19.2% of Medicare recipients with T2DM not on insulin, assuming a growth of 4.2% per year in recipient numbers, over a three-year horizon. Costs included provision of SMBG and CGM devices and healthcare resource utilization (HCRU) due to ADEs and long-term complications. Annual per-patient costs over three years for using CGM were $204 lower than for using SMBG, due to reduced HCRU costs. Overall costs to Medicare would be reduced considerably from year 1, with annual savings of $1.6 billion in year 3.

When the cost-impact of using CGM over a three-year horizon from a national commercial healthcare perspective,[2] the analysis covered 30 million people with T2DM on insulin or non-insulin therapy. When CGM reimbursement was expanded to cover all individuals with T2DM, the reduction in emergency room and hospitalization costs related to ADEs and long-term complications was associated with cumulative cost savings of $1.3 billion over three years. A major cost-impact element was the savings against HCRU costs for people with T2DM using insulin provided with CGM rather than SMBG.

These analyses confirm that providing access to CGM for people with T2DM, including those on non-insulin therapy, results in significant cost savings against emergency treatment and hospitalization for ADEs and long-term complications of diabetes. These make CGM a cost-effective intervention, compared to using SMBG, across diverse healthcare reimbursement plans.

1. Munshi M, *et al.* CGM for People with T2DM Not on Insulin—Budget Impact Analysis from a Medicare Perspective. American Diabetes Association 85th Scientific Sessions, 1062-P

2. Rowes JR, *et al.* CGM for People with T2DM Not on Insulin—Budget Impact Analysis from Commercial Plans Perspective. American Diabetes Association 85th Scientific Sessions, 1068-P

Morning fasting glucose levels are not the most common minimum glucose of the day for people with T2DM on basal insulin

When titrating basal insulin for people living with T2DM, measuring fasting blood glucose (FBG) in the morning is often used as a measure to adjust the basal insulin dose as it is often the lowest glucose in a 24-hour period. However, the actual minimum glucose of the day (MGD) can occur at any time.

This retrospective study examined real-world glucose data from de-identified FreeStyle Libre 2 system users to determine when daily MGD values occurred for basal-insulin treated individuals with T2DM.[1] For the purpose of this study, MGD is defined as the lowest one-hour average of CGM data each day. For each user, 15 consecutive days were randomly selected in which an MGD was identified.

Data from 3,137 FreeStyle Libre 2 system users with T2DM on basal insulin therapy showed that 39% of the MGD values occurred between 10AM and 10PM each day, with fewer than 15% of MGD values occurring between 6AM and 9AM, the typical timing of self-monitoring of FBG. This was the same for individuals being treated with sulfonylurea or meglitinide agents.

These observations are an important new insight to assist in basal insulin titration strategies for people with T2DM and show that using morning FBG may not provide the MGD readings that are most appropriate for effective up-titration or down-titration of basal insulin doses, which are currently recommended in guidelines.[2] Rather, it can be concluded that CGM is a more-objective tool for identifying MGD, which may be a safer strategy for basal insulin titration for people with T2DM.

1. Bhattacharya A, *et al.* Minimum Glucose of the Day in People with Type 2 Diabetes on Long-Acting Insulin. American Diabetes Association 85th Scientific Sessions, 989-P

2. Davies MJ, *et al.* Management of hyperglycaemia in type 2 diabetes, 2022. A consensus report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetologia*. 2022; 65:1925-1966 [https://pubmed.ncbi.nlm.nih.gov/36151309/]

Using the FreeStyle Libre 3 system positively impacts engagement and diabetes self-management behaviours for adults with T2DM

A recent randomized controlled trial (RCT) demonstrated improvements in patient-reported engagement with diabetes self-care and glycemic management in new users of the Freestyle Libre 3 system, compared to self-monitoring of blood glucose (SMBG) users. The study reported here explored how using the FreeStyle Libre 3 system led to these behavioral and glycemic changes for adults with T2DM.

At study end, 31 adults with T2DM on basal or non-insulin treatment in the FreeStyle Libre 3 arm of the RCT completed in-depth semi-structured interviews, with questions focused on the impact of FreeStyle Libre 3 system use on diabetes-related attitudes, changes in quality of life and lifestyle behaviors. Thematic analysis was developed using two independent reviewers to code each interview, and a 3rd party reviewer identifying disparities until consensus was reached.

Behavioural changes resulting from use of the FreeStyle Libre 3 system included: T2DM now seeming more "real/visible" (94% of respondents), effective decision-making seeming more possible (68%), and enhanced self-efficacy (65%). Notably, enhanced self-efficacy was associated with reductions in HbA1c over the 3-month study period (p=0.02). Key changes using the FreeStyle Libre 3 system included improvements in diet, physical activity, and medication use. At study end, 94% of participants were interested with continuing the use of FreeStyle Libre 3 system, but 74% reported they could not, primarily due to cost. Of concern, 52% reported regressing to pre-study behaviors.

These findings provide critical insight into how using the FreeStyle Libre 3 system can positively impact engagement with diabetes self-management and glycemic control, and highlight the importance of continuing to ensure broad access to CGM technology.

Polonsky WH, *et al.* How CGM Use Affects Diabetes-Related Attitudes and Behaviors in People with T2D—A Qualitative Investigation. American Diabetes Association 85th Scientific Sessions, 2036-LB

researchupdates

Microvascular and macrovascular complications are inversely correlated with time in range for CGM users with T1DM

In the RESCUE and FUTURE observational cohort studies, the use of real time CGM or the FreeStyle Libre systems by people with T1DM was associated with significant reductions in hospital admissions for acute diabetes events, such as DKA or severe hypoglycemia.[1,2]

A retrospective analysis of the data from 808 participants with T1DM from these two studies[3] showed that both time in range (TIR) 70–180 mg/dL (3.9–10.0 mmol/mol) and time in tight range (TITR) 70–140 mg/dL (3.9–7.8 mmol/mol) were inversely correlated with the occurrence of microvascular complications or cerebrovascular accidents (CVAs) after adjustment for HbA1c. For every 10% increase in TITR the risk of any microvascular complication was reduced by –13.3% (p=0.032), including a –16.3% fall in risk of diabetic retinopathy (p=0.027). Risks for CVA were reduced by –38.1% with each 10% increase in TITR (p=0.012). Similar reductions in risks for these microvascular and macrovascular complications were also seen for each 10% increase in TIR.

This analysis underlines the importance of actively managing CGM derived metrics as part of dynamic glycaemic control in addition to long-term HbA1c, as such measures such as TIR and TITR allow a more comprehensive understanding of an individual's glucose profile.

1. Charleer S, *et al.* Effect of Continuous Glucose Monitoring on Glycemic Control, Acute Admissions, and Quality of Life: A Real-World Study. *J Clin Endocrinol Metab*. 2018;103:1224–1232. [https://pubmed.ncbi.nlm.nih.gov/29342264/]

2. Charleer S, *et al.* Quality of Life and Glucose Control After 1 Year of Nationwide Reimbursement of Intermittently Scanned Continuous Glucose Monitoring in Adults Living With Type 1 Diabetes (FUTURE): A Prospective Observational Real-World Cohort Study. *Diabetes Care*. 2020;43:389–397. [https://pubmed.ncbi.nlm.nih.gov/31843948/]

3. Meulemeester JD, *et al.* The association of chronic complications with time in tight range and time in range in people with type 1 diabetes: a retrospective cross-sectional real-world study. *Diabetologia*. 2024;67:1527–1535. [https://pubmed.ncbi.nlm.nih.gov/38787436/]

Evidence links CGM sensor use to lower mortality and reduced cardiovascular disease among people with T2DM

An observational cohort study investigated whether initiating CGM technology reduced mortality and clinical event rates in people with T2DM.

Researchers analyzed data from 12,729 patients with T2DM (94% male, mean age 66) who began using CGM. These individuals were matched 1:1 with non-CGM users. During a total follow-up of 17,676 person-years for CGM users and 17,034 person-years for non-users, CGM use was associated with a 21% lower risk of mortality (hazard ratio [HR] 0.79), compared to matched CGM non-users control. CGM users also had lower risks of all-cause hospitalization (HR 0.91), cardiovascular events (HR 0.84), and hyperglycemia-related admissions (HR 0.88).

The reduction in mortality persisted after accounting for early deaths, COVID-19, diabetes duration, insulin pump or newer drug use, frailty, and mortality risk scores. These results suggest that CGM use may offer benefits beyond glucose control, including reduced mortality and fewer serious complications.

Reaven PD, *et al.* Initiation of continuous glucose monitoring and mortality in type 2 diabetes. *Diabetes Technol Ther*; 2025. doi: 10.1089/dia.2025.0227. [https://pubmed.ncbi.nlm.nih.gov/40432529/]

Using CGM can minimize nocturnal hypoglycemia and reduce risks for daytime severe hypoglycemia in T1DM

The HypoDE randomized controlled trial confirmed that using CGM in people with T1DM on intensive insulin therapy could minimize problems with hypoglycaemia compared to self-monitored blood glucose (SMBG). The current analysis reports on the HypoDE data in the context of nocturnal and daytime hypoglycemia.

The data from the 141 participants in HypoDE shows that, although the frequency of nocturnal and daytime hypoglycemia are similar, nocturnal episodes last significantly longer. Consequently, nocturnal hypoglycemia is a stronger predictor of daytime hypoglycemia than daytime hypoglycemia is for nocturnal hypoglycemia. More importantly, in the absence of CGM, nocturnal hypoglycemia often goes undetected and the association between daytime hypoglycemia and the occurrence of severe hypoglycemic events (SHE) requiring third-party assistance is strengthened.

This analysis indicates that the use of CGM by people with T1DM can reduce daytime hypoglycemia and risks for SHEs by minimizing the frequency and duration of nocturnal hypoglycemia. In addition, reduced nocturnal hypoglycemia can minimize sleep disruption and fatigue, that otherwise add to the burden of living with T1DM.

This virtuous cycle of improved glycemia is further validation of wider application of CGM technology for people with diabetes. Furthermore, by limiting the impact of hypoglycemia it is proposed that there will be significant cost savings from reduced hospital visits and productivity losses, such that provision of CGM is cost-effective, even in middle- and low-income countries.

Hermanns N, *et al.* Continuous glucose monitoring as equinox of nocturnal and daytime hypoglycaemia in type 1 diabetes: insights from the randomized controlled HypoDE trial. *Diabetes Res Clin Pract.* 2025; Jun:224:112228. [https://pubmed.ncbi.nlm.nih.gov/40348338/]

Nocturnal hypoglycemia detected by CGM is predictive of microvascular disease

This study tested whether exposure to hypoglycemia at specific thresholds identified by the FreeStyle Libre system can predict microvascular disease in adults with T2DM.

In this cross-sectional study, 174 adults with T2DM wore FreeStyle Libre devices for 14 days to examine links between hypoglycemia and microvascular disease. While 79.9% of participants experienced at least one hypoglycemic episode, those with microvascular disease were significantly more likely to have glucose levels fall below 3.4 mmol/L (61 mg/dL) (57.6% vs 39.8%; p=0.023). Daytime hypoglycemia rates did not differ between groups, but nocturnal events (between 22:00–06:00) were strongly predictive of microvascular disease. Even after adjusting for age, BMI, diabetes duration, HbA1c, therapies, lipids, and renal function, nocturnal hypoglycemia at any threshold below 3.9 mmol/L (70 mg/dL) was present in a greater proportion of those with microvascular disease (62.1 vs. 46.3%, p=0.043).

The risk of experiencing microvascular disease increased further as nighttime glucose dropped incrementally lower, with odds ratios rising from 1.34 at <3.4 mmol/L (<61 mg/dL) to 1.86 at <3.0 mmol/L (<54 mg/dL). Subgroup analysis revealed associations with retinopathy and neuropathy, but not nephropathy. These findings support time-divided hypoglycemia thresholds and highlight the clinical relevance of silent nocturnal lows in the development of diabetes-related microvascular damage.

Li J, *et al.* Time-divided hypoglycemia management derived by continuous glucose monitoring may reduce microvascular diseases in type 2 diabetes patients. *Endocrine.* 2025. doi: 10.1007/s12020-025-04250-7 [https://pubmed.ncbi.nlm.nih.gov/40346326/]

Mitigating glycemic changes in medicine: the wider impact of using CGM technology

Beyond its established use in T1DM, this review evaluates the value of using CGM across a spectrum of conditions, both to improve clinical management and also to better understand their pathophysiology.

CGM's ability to capture glucose dynamics in real time offers a transformative view beyond static HbA1c values. The evidence for CGM use in T2DM, both insulin and non-insulin treated, is now well established, demonstrating improvements in HbA1c, time-in-range, and glycemic variability. However, use of CGM has also shown potential in other scenarios where traditional glycemic markers fall short. These include end-stage kidney disease (ESKD), when HbA1c becomes unreliable as a consequence of altered red blood cell turnover and protein glycation. Similarly, obstructive sleep apnea (OSA) is linked with insulin resistance and severity of OSA is associated with increased mean glucose. Use of CGM has been shown to help monitor the impact of continuous positive airway pressure (CPAP) treatment in OSA.

CGM has been used to detect the glycemic impact of delayed nutrient absorption in gastroparesis, and has been used to monitor and predict remission of T2DM following bariatric surgery. Across these diverse clinical conditions, CGM has revealed patterns missed by traditional metrics and with accuracy that can be used for making treatment decisions.

Agarwal S, *et al.* Moving beyond HbA1c to glucose patterns: Newer indications for CGM use. *Endocr Pract.* 2025: Jun 4:S1530-891X(25)00901-2. [https://pubmed.ncbi.nlm.nih.gov/40480501/]

Predicting risks for hypoglycemia in people with T2DM despite on-target TIR

This study explored whether continuous glucose monitoring (CGM) data could predict hypoglycemia in individuals with T2DM who meet time in range (TIR) target criteria.

In this retrospective study, CGM data from 111 adults with T2DM were analyzed. All participants had TIR 3.9–10.0 mmol/L (70–180 mg/dL) >70%, yet some still experienced hypoglycemia. The study investigators developed a predictive model using multiple glycemic variability (GV) indicators, including mean glucose, standard deviation (SD), coefficient of variation (CV), and low blood glucose index (LBGI). In univariate analysis, SD, CV, LBGI, and other GV metrics were significantly higher in the hypoglycemia group. Multivariate logistic regression confirmed SD, MBG, and LBGI as independent predictors.

Among the study participants, all of whom achieved >70% TIR, 47.5% experienced level 1 hypoglycemia (<3.9 mmol/L (<70 mg/dL) and 18.9% experienced level 2 hypoglycemia <3.0 mmol/L (<54 mg/dL). The final model yielded an area under the curve (AUC) of 0.93 (95% CI: 0.88–0.97), showing strong predictive performance for the individuals most likely to experience hypoglycemia. This analysis showed that individuals with T2DM can be at risk for hypoglycemia, even when TIR meets clinical targets. These findings offer clinicians a practical CGM-based model to catch hidden hypoglycemia risk in otherwise well-controlled patients.

Lu J, *et al*. A CGM-based model for predicting hypoglycemia in type 2 diabetes patients with TIR in target. *Diabetol Metab Syndr*. 2025, 17:169. [https://pubmed.ncbi.nlm.nih.gov/40410885/]

Nurse-led telemonitoring with CGM improves glycemic outcomes in T2DM compared with standard care

This trial assessed whether use of CGM with remote glucose monitoring and nurse-led insulin titration improves outcomes versus standard outpatient care in insulin-treated T2DM.

In a national, open-label, multicenter randomized controlled trial conducted in Denmark, adults with T2DM on insulin therapy were randomized to receive either standard care or an intervention with CGM and connected insulin pens, with activity monitoring devices and utilizing telemonitoring apps. Their data were monitored by hospital staff, who provided follow-up via telephone during the three-month study period.

The primary endpoint was the change in time in range (TIR) 70–180 mg/dL (3.9–10.0 mmol/L) from baseline to three months. The telemonitoring group had significantly greater improvements in TIR compared to standard care, with a treatment difference of +13.6% over 3 months (p=0.004). Furthermore, the telemonitoring group achieved a 7.6 mmol/mol reduction in HbA1c.

These findings demonstrate the effectiveness of CGM-based telemonitoring in improving glycemic control among patients with T2DM on insulin therapy. This approach may offer a valuable alternative to conventional care, leveraging technology to enhance outcomes and reduce the need for frequent in-person clinic visits.

Hangaard S, *et al*. Effectiveness and safety of telemonitoring compared with standard of care in people with type 2 diabetes treated with insulin: A national multicenter randomized controlled trial. *Eur J Intern Med*. 2025; May 24:S0953-6205(25)00209-2. [https://doi.org/10.1016/j.ejim.2025.05.017]

Too high, too often: CGM reveals severe hyperglycemia in long-term care residents

This prospective observational study used masked CGM for 10 days to assess the extent of hyperglycemia and hypoglycemia among residents with T2DM in long-term care facilities.

A total of 65 residents completed the study (median age 68 years), of whom 63% reporting a recent history of falls and 25% having a diagnosis of cognitive impairment. Most participants were on insulin (68%), with 64% using non-insulin agents and 11% receiving sulfonylureas. Mean HbA1c of the cohort was 7.2% (55 mmol/mol). Review of masked CGM data revealed that 26% of participants spent at least 1% of the monitored time in hypoglycemia <3.9 mmol/L (<70 mg/dL). A higher burden of hyperglycemia was confirmed by the CGM data: 52% of residents spent more than 10% of time above range (TAR) with glucose >13.9 mmol/L (>250 mg/dL), 37% of residents had >25% TAR, and 18% had >50% (TAR).

In addition to their diabetes treatment, participants had a median of 13 comorbidities and took a median of 19 medications daily. These findings highlight the presence of both hyper- and hypoglycemia in this population despite average HbA1c values, supporting the role of CGM in identifying hidden glycemic risks.

Munshi MN, *et al*. Excessive burden of hyperglycemia along with hypoglycemia in long-term care facilities identified by continuous glucose monitoring. *J Am Med Dir Assoc*. 2025; 26(6):105590. [https://pubmed.ncbi.nlm.nih.gov/40233808/]

Pharmacist-led management of adults with T2DM using CGM improves glycemic outcomes

This study evaluated outcomes from a pharmacist-led diabetes management and education clinic (DMEC) for adults with T2DM using CGM in a large academic health system.

Researchers conducted a retrospective review of 165 adults with T2DM who received care through a pharmacist-managed DMEC program over a 6-month period, in which CGM data was used to guide treatment decisions. Outcomes included changes in HbA1c and CGM metrics after the study period, compared to baseline prior to the introduction of CGM technology.

During the study period, mean HbA1c was reduced significantly by –1.48% (–16.2 mmol/mol) at 3 months and –1.74% (–19.1 mmol/mol) at 6 months (both p<0.00 1). Time in range (TIR) 70–180 mg/dL (3.9–10 mmol/L) increased by 8.2% at 3 months and by 12.1% at 6 months. Average glucose and glucose management indicator (GMI) also showed significant reductions.

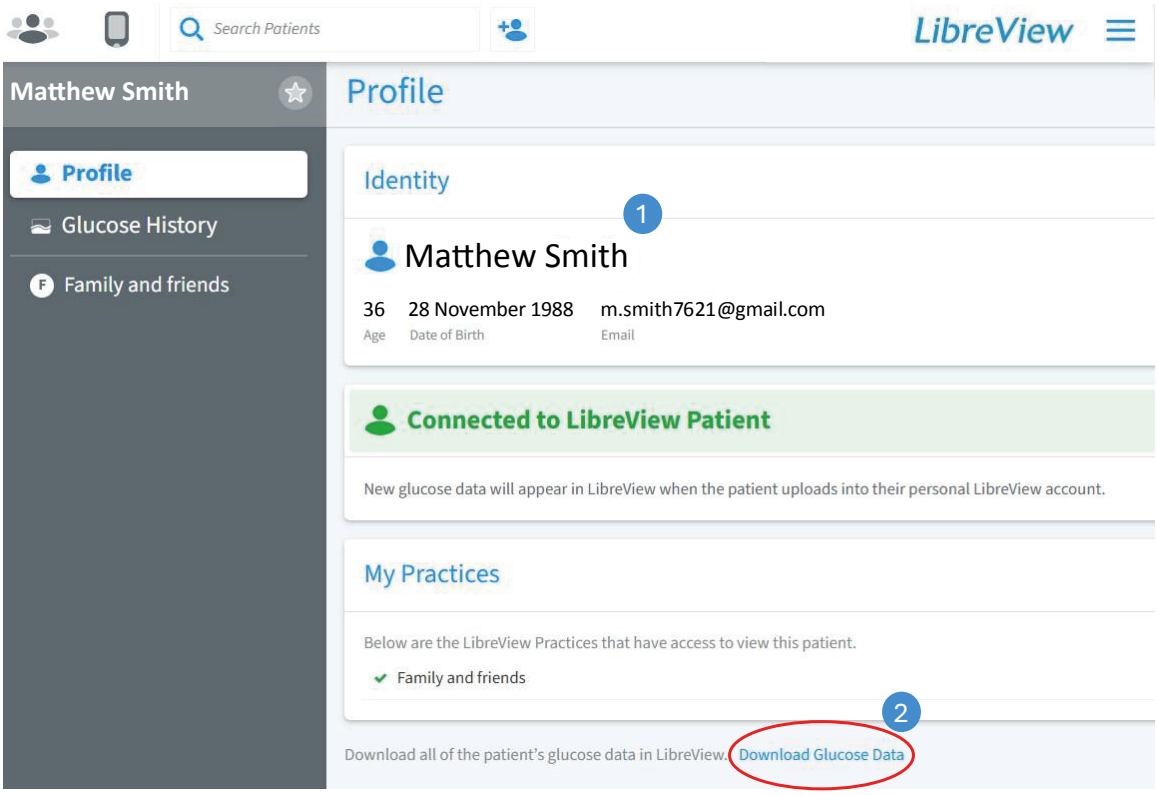
These results highlight the value of CGM-enabled, pharmacist-led care models in improving glycemic outcomes for patients with T2DM in a real-world, academic primary care setting. This has implications for a reduced burden and cost of diabetes care for specialist services.

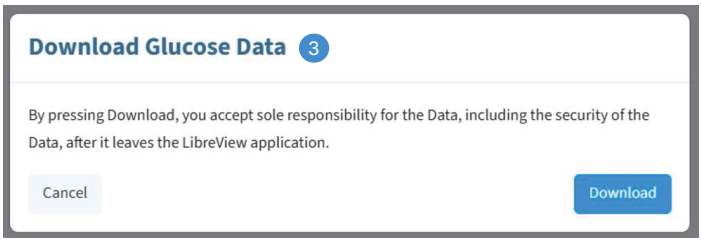
Mnatzaganian C, *et al*. Evaluation of pharmacist-led management of type 2 diabetes using personal continuous glucose monitors across a large tertiary academic health system. *J Am Pharm Assoc*; 2025, 65(4):102397. [https://pubmed.ncbi.nlm.nih.gov/40189103/]

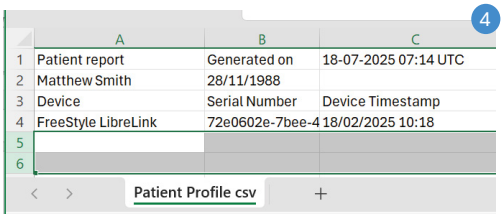
Downloading glucose data from LibreView to improve the care of your patients

The data captured by the FreeStyle Libre systems and shared with the health care team via connecting patient LibreView account to professional LibreView account, these data displayed within the LibreView platform[1] can be downloaded in a basic **spreadsheet format**, compatible with commonly available spreadsheet programs. By doing this, the data for a single patient can be downloaded to enable analysis with the tools available in the spreadsheet software.

1. Select the patient whose data you wish to download.
2. Click on the **Download Glucose Data** link at the bottom of the page.
3. Standard data security pop-ups will ask you to **confirm that you are not a robot** and to notify you that you **accept sole responsibility** for the data once it is downloaded from LibreView.
4. The glucose data will then be downloaded to a **comma separated .CSV file**, compatible with the spreadsheet software.







Images are for illustrative purposes only. Not real patient data.
[1]The LibreView website is only compatible with certain operating systems and browsers. Please check www.libreview.com for additional information.

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