FreeStyle living with diabetes: learning from case studies 2024

COMPASS ASSURANCE • ISO 9001 QUALITY •

ADEA

Your trusted partner in diabetes care

Acknowledgement

ADEA acknowledges the generous contributions from the following members of the review panel:

- Ann Bush, RN CDE, ADEA
- Karen Crawford, RN CDE
- Angela Llewellyn, RN CDE
- Peta Tauchmann, RN CDE
- Dr Sue Lynn Lau, Endocrinologist

Thank you to all who attended this year's Australasian Diabetes Congress (ADC).

FreeStyle living with diabetes: learning from case studies 2024 is financially supported by Abbott.

Disclaimer

1. The claims and opinions expressed in these published case studies are those of the authors and do not necessarily reflect the view of ADEA, unless stated otherwise.
2. Content in this publication is provided for health professionals only and is not intended to be used by consumers, people with diabetes and carers.
3. The information provided is for the purposes of general medical education and is not meant to substitute the independent medical judgment of a health professional regarding specific and individualised treatment options for a specific client's medical condition.
4. No responsibility is accepted by ADEA, publishers or the printers for the accuracy of information contained in the text or advertisements and readers should rely on their own enquiries prior to making any decision touching their own interests.
5. The individuals living with diabetes discussed in these published case studies were all de-identified.
6. The individuals living with diabetes discussed in these published case studies consented to the publication of these case studies in this print publication.
7.

About ADEA

The Australian Diabetes Educators Association (ADEA) has been the peak organisation for diabetes education in Australia for 43 years. It is the accreditation body for the diabetes education profession through the ADEA Credentialling Program and leads the way in recognising best practice in diabetes education, diabetes care, and diabetes self-management. ADEA also reviews and endorses educational programs developed by external organisations for professional development purposes.

Among the 2,465* ADEA members, more than 1,680* are Credentialled Diabetes Educators (CDEs) in Australia. These specialists in diabetes education, management, and care offer support to the estimated 1.5 million people living with diabetes in Australia.

ADEA works closely with Diabetes Australia and the Australian Diabetes Society to lead and advocate for contemporary, evidence-based best practice, person-centred diabetes education, and care for people with diabetes.

About Abbott

Abbott is committed to helping people living with diabetes live the best possible life through the power of health. For more than 125 years, Abbott has brought new products and technologies to the world—in nutrition, diagnostics, medical devices, and branded generic pharmaceuticals—that create more possibilities for more people at all stages of life. Today, 113,000 Abbott employees are working to help people live not just longer, but better, in more than 160 countries that we serve.

**Numbers as of 30 June 2024.*

List of shortened forms

ADC	Australasian Diabetes Congress
ADEA	Australian Diabetes Educators Association
AGP	Ambulatory Glucose Profile
APD	Accredited Practising Dietitian
BG	Blood glucose
BGL	Blood glucose level
BHN	Better Health Network
BMI	Body mass index
CDE	Credentialled Diabetes Educator
CGM	Continuous glucose monitoring
DNE	Diabetes Nurse Educator
eGFR	Estimated Glomerular Filtration Rate
GFR	Glomerular Filtration Rate
GLP-1	Glucagon-like peptide-1
GMI	Glucose Management Indicator
GP	General practitioner
ICR	Insulin carbohydrate ratio
ISF	Interstitial fluid
LADA	Latent autoimmune diabetes in adulthood
MAFLD	Metabolic-associated Fatty Liver Disease
NDSS	National Diabetes Services Scheme
NP	Nurse Practitioner
OHG	Oral hypoglycaemics
RACGP	Royal Australian College of General Practitioners
RN	Registered Nurse
SG	Sensor glucose
SGL	Sensor glucose level
SGLT2	Sodium-glucose co-transporter 2
SMBG	Self-monitoring of blood glucose
TIR	Time in range
VLCD	Very low-calorie diet

FreeStyle living with diabetes: Learning from case studies 2024

FreeStyle living with diabetes: learning from case studies 2024 is run to acknowledge and reward case studies that address contemporary issues in the practice of diabetes care, diabetes education, and self-management in the use of Freestyle Libre CGM system and Ambulatory Glucose Profile (AGP).

Submitted case studies include principles of person-centred care and aims to adhere to the Diabetes Australia Position Statement: Our Language Matters. The cases discuss the use of Freestyle Libre CGM system and LibreView, including the AGP Report, while addressing the following questions:

1. How have the client's outcomes (clinical or non-clinical) improved with this technology?
2. How has the technology been used to make a difference to a client's quality of life?
3. How has the technology changed practice for an individual health professional or the diabetes care team?
4. How has it helped to prevent an adverse event?
5. What are the challenges clients have found with this technology? What has been done as a consequence?
6. Discuss innovative ways used to increase TIR.
7. How has the FreeStyle Libre or Libre 2 helped facilitate living with diabetes?
8. Case studies referencing the use of the NovoPen 6 with the LibreLink App is encouraged when clinically relevant.

The top 10 case studies are featured in this booklet. In round one, a panel of judges selected the top 10 case studies for publication. The top four authors were invited to round two where they presented their case studies. Judges voted on the presentation content and quality. Winners were ranked first to fourth.

One entrant was selected for the Early Career Award and invited to present their case at the ADC. Their presentation was not judged. To be eligible for this award, applicants are required to be a current full member of ADEA, have less than two years' experience as a CDE or working towards initial credentialing, and have not previously entered the Abbott Case Study Competition. The case studies in this publication are ordered alphabetically by the authors' surnames.

Content

Case one

Fran Brown

Diabetes discovery — Libre 2 brings newfound self-determination

P 09

Case two

Yi (Angela) Jin

Overcoming therapeutic stagnation: A culturally responsive approach to improved glycaemic control and psychological well-being in type 1 diabetes

P 19

Case three

Rachel McKeown

Curbing carers' concerns — FreeStyle living for support people of the person living with diabetes

P 29

Case four

Beck Newton

Leveraging continuous glucose monitoring to improve type 2 diabetes management

P 54

Case five

Abi Oliver

Using continuous glucose monitoring to improve outcomes and quality of life of an older person living with type 1 diabetes

P 63

Case six
Early career

Prue Reyne

Using the Libre 2 sensor on a patient undertaking a very low-calorie diet (VLCD) pre-bariatric surgery

P 75

Case seven

Sabina Sharp

Supporting our patient by enhanced technology to achieve safe glucose levels and autonomy in palliative self-care during chemotherapy

P 83

Case eight

Early career

Sulochi Subasinghe

Use of FreeStyle Libre 2 glucose monitoring to optimise diabetes management

P92

Case nine

Early career

Edith Wilson

FreeStyle Libre 2 — relieving diabetes burden

P 103

Case ten

Early career

Amy Zheng

Revealing the unexpected: technology's role in discovering secondary causes of hyperglycaemia

P 112

Case one

Fran Brown

Diabetes discovery — Libre 2 brings newfound self-determination

Introduction

Introducing Mary, (de-identified), a 56-year-old married woman working as an accountant and living with her husband and two adult sons. She was referred to a local diabetes education service by her endocrinologist, who had recommended commencement of insulin therapy using Ryzodeg 70/30, 10 units before the evening meal. Mary's appointment was booked with a CDE, who is also an endorsed nurse practitioner (NP).

Mary was diagnosed with type 2 diabetes in 2015. At this time, her HbA1c was 7.5%, her weight was 83kg, and her body mass index (BMI) was 30.5 (classified as Class I obesity) [1]. Mary was taking metformin XR, 1000 mg mane, and 500 mg nocte. Her medical history included hypertension, managed with metoprolol 25 mg bd; and sagittal sinus thrombosis, requiring lifelong clopidogrel, 75 mg daily. Mary was not unfamiliar with type 2 diabetes as her father and two uncles also had diabetes.

Mary's HbA1c had been greater than 8.5% for the past year despite her efforts. Her medications include Jardiamet, 12.5 mg daily, and semaglutide, 1 mg weekly, resulting in a weight loss of 12 kg. Since diagnosis, her medical history now includes hypercholesterolaemia, managed with rosuvastatin 10 mg daily, and fatty liver disease, confirmed on ultrasound. She is also seeing a rheumatologist for psoriatic arthritis, a chronic autoimmune form of arthritis.

Assessment

Mary was feeling quite fearful and anxious about starting insulin as she thought her glucose levels would drop too low. She was also worried about weight gain. Her weight was 68.2 kg, with a random BG of 9.2 mmol/L, blood ketones of 0.2 mmol/L and blood pressure of 125/86.

Mary was symptomatic of hyperglycaemia, reporting nocturia and tiredness. She was not checking blood glucose levels (BGLs). Her BMI had reduced to 25.1 essentially defining her weight as normal range.

Given Mary's weight loss, chronically elevated HbA1c and history of an autoimmune condition, a differential diagnosis of latent autoimmune diabetes in adulthood (LADA) could not be ruled out. This would have implications on medication use resulting in a change to insulin management, using multiple daily injections instead of pre-mixed insulin. This was raised with the endocrinologist for further consideration.

In addressing Mary's concerns, a trial of the Libre 2 glucose sensor was offered. This would allow not only the ability to view real-time glucose levels on her mobile phone continuously, but it would also allow her to receive an alarm if her glucose level was to drop.

Using the Libre 2 sensor would also allow Mary to share her data via LibreView, enabling the NP to support her via a cloud-based connection.

Management

Commencing insulin

Education was provided on the action of Ryzodeg 70/30, correct timing of injections, storage of insulin, how to identify and treat hypoglycaemia and accessing pen needles from the National Diabetes Services Scheme (NDSS). A practical demonstration of the correct injection technique and site selection was provided, with Mary practising this skill under the supervision of the NP until she felt confident. The rationale for notifying VicRoads that Mary was commencing insulin was also outlined.

Regarding the use of Libre 2, Mary was educated about site selection, skin preparation, correct sensor insertion, care of the sensor, and how to remove the sensor once it expired. Most importantly, education was provided on how to interpret sensor glucose (SG) values, understanding trend arrows, setting and responding to alarms, and setting goals regarding glycaemia. Having an SG value every minute may be overwhelming for Mary; however, an explanation of how post-meal glucose analysis can help with understanding

how various foods and activities can influence glucose levels was highlighted. The low alert was set at 4.3 mmol/L.

A decision was made to delay the introduction of the NovoPen 6 to allow Mary time to adjust to new technologies slowly.

Week one review — via phone

Mary was pleased with her progress and had not experienced any low glucose levels. Mary was guided to her LibreLink app to discuss the low glucose events report. This report provides data about the total number of events where the SG has dropped below 3.9 mmol/L. It provides further detail on each three-hour period, indicating when low events have occurred. As supported by the AGP Report, there were zero events since starting insulin.

Mary asked some questions about eating out. She had identified meals that had resulted in higher glucose levels, which was enlightening for her.

The report showed 44% of her glucose levels were in the target range of 3.9–10.0 mmol/L. It was outlined to Mary that the goal for treatment would be to achieve 70% of her glucose levels in the target range[2, 3].

It should be noted that for completeness, the data on the AGP Report should summarise data during a full 14-day period[3]; however, there was enough data in seven days to reveal that overnight glucose levels were responding, with the daily patterns report showing average glucose levels of < 10.0 mmol/L. Waking glucose levels were averaging 7.6 mmol/L. The Glucose Management Indicator (GMI) was noted at 8% with glucose variability at target (23.1%); however, further analysis during a two-week period is recommended.

What also emerged on the AGP and daily patterns reports was that daytime glucose levels were mostly > 10.0 mmol/L and peaked at an average of 14.4 mmol/L late in the afternoon, suggesting the need for a morning dose of Ryzodeg 70/30 (figures 1 and 2). After careful consideration and discussion, the NP advised Mary to add a dose of 10 units before breakfast. The endocrinologist had alluded to the likelihood of twice-daily insulin being required, and Mary agreed to this plan.

Figure 1

AGP Report

22 February 2024 - 28 February 2024 (7 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

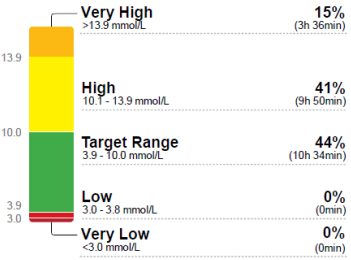
22 February 2024 - 28 February 2024	**7 Days**
Time sensor active:	**89%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 3.9-10.0 mmol/L	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

Average Glucose	**11.0** mmol/L
Glucose Management Indicator (GMI)	**8.0% or 64 mmol/mol**
Glucose Variability	**23.1%**

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.

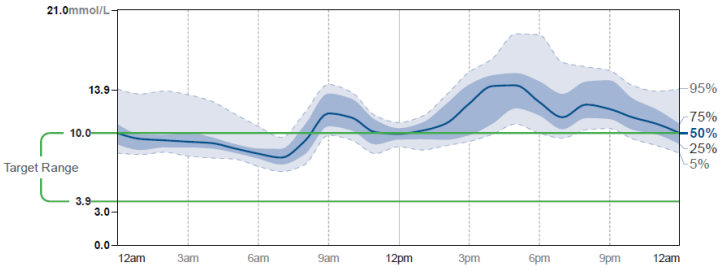
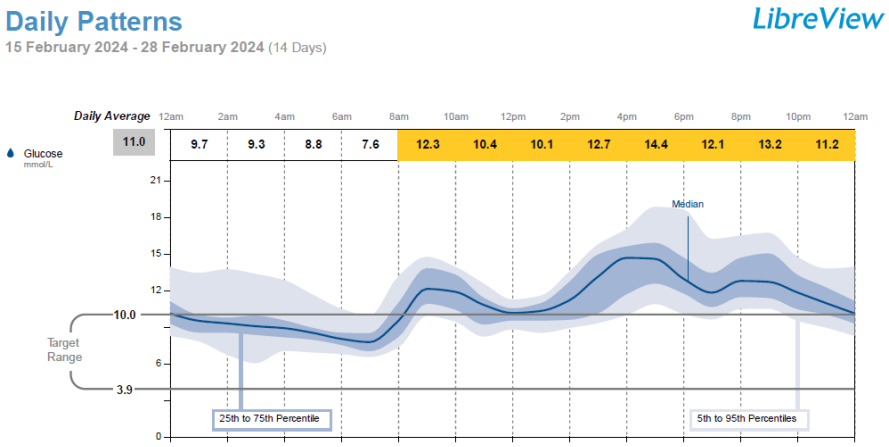


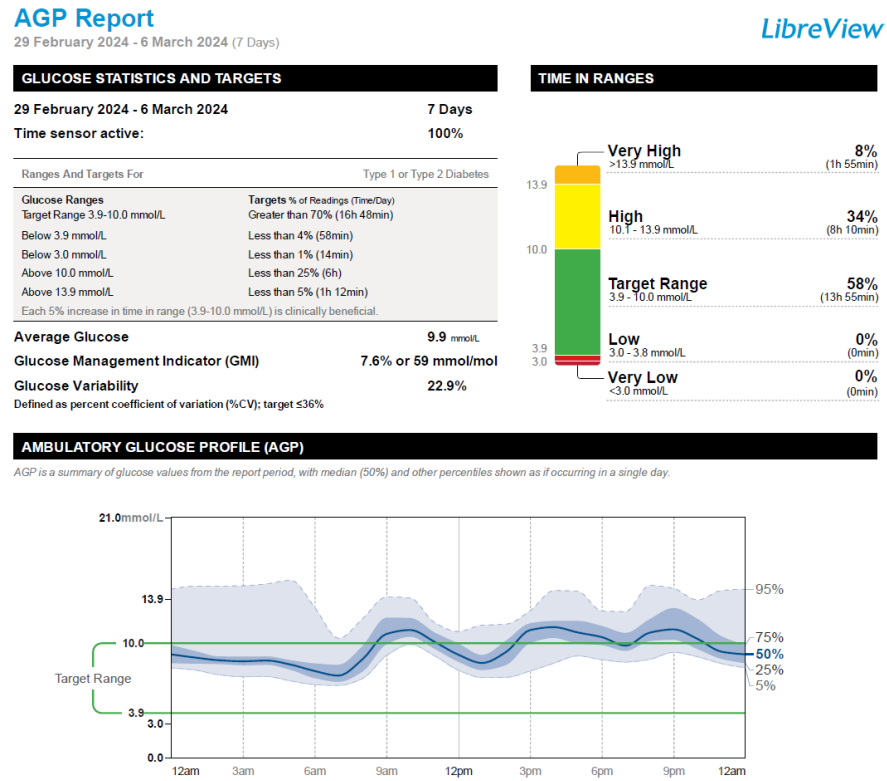
Figure 2



Week two review — via phone

To assess the impact of introducing a morning insulin dose, an AGP Report from the previous seven days was generated and compared to the week prior (figure 3). The TIR had increased from 44% to 58%, and Mary had remained free from hypoglycaemia. The GMI had reduced further to 7.8%, and glucose variability was stable at 23.5% (generated using two weeks of data — not shown).

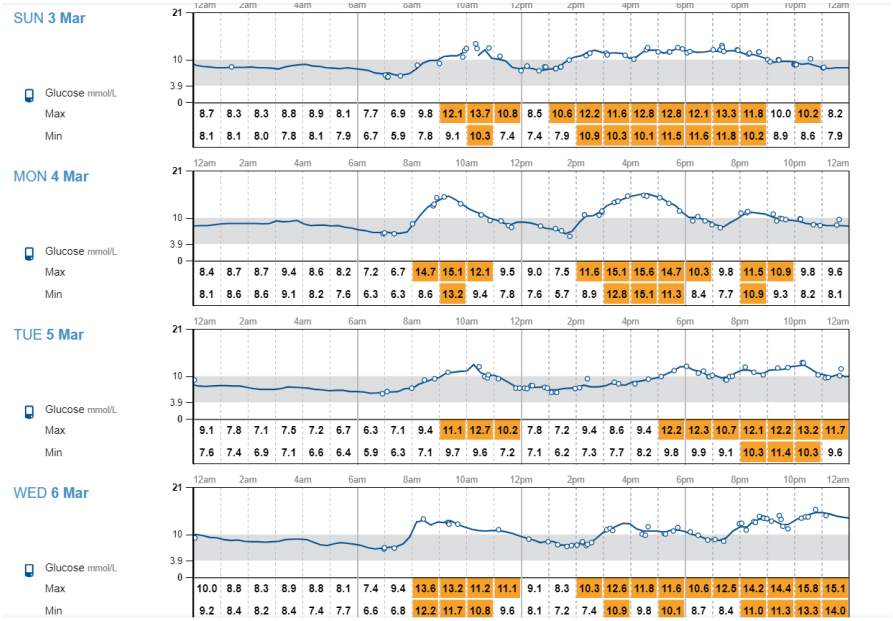
Figure 3



The daytime glucose levels persisted. Instructions about how to access the LibreView account online were provided. The Daily Log report identified glucose levels of > 10.0mmol/L by an orange highlight (figure 4). The minimum and maximum glucose levels for every hour were reported, with Mary confirming the hyperglycaemia was consistent with her post-meal periods. The overnight glycaemia continued to be stable. Based on this analysis, Mary was advised to increase the morning insulin dose from 10 units to 12 units. The evening dose remained at 10 units.

An in-clinic appointment was scheduled for two weeks later where the NovoPen 6 would be introduced.

Figure 4



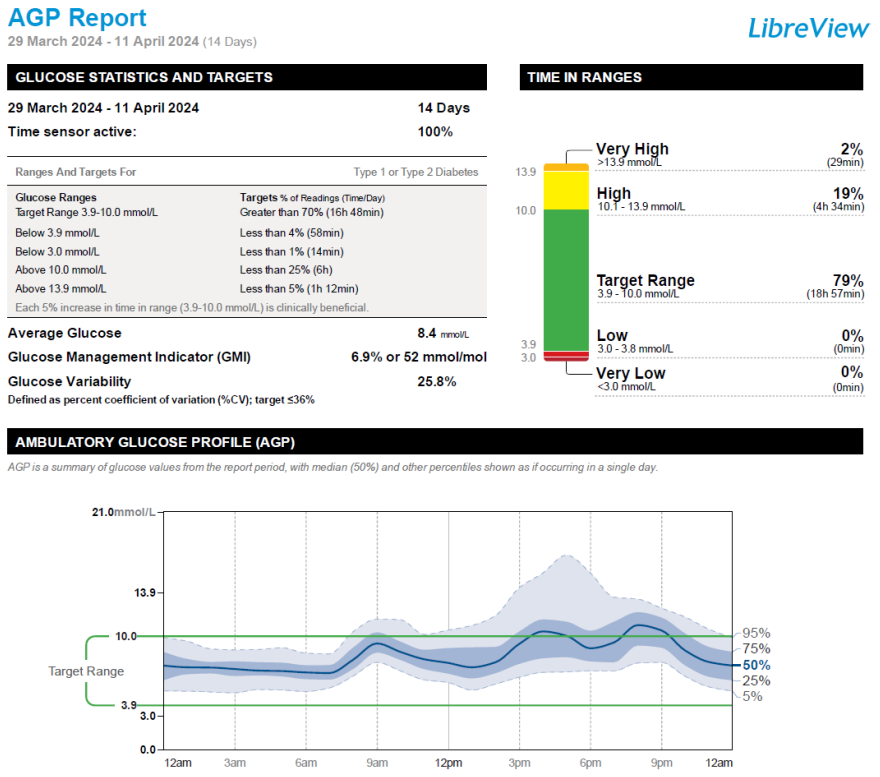
In-clinic follow-up

Mary had contacted the NP in between visits for further advice about insulin dose adjustment, resulting in an increase of the pre-breakfast dose to 16 units. The evening dose remained unchanged.

Mary attended for a face-to-face appointment where she shared that she had subscribed to use Libre 2 full-time. She felt the information provided by this tool was instrumental in helping her learn about what foods to avoid, as well as assuring her that she was safe. She was now contemplating exercise.

Mary's weight had reduced to 67 kg, indicating she had lost rather than gained weight since starting insulin. Her blood pressure was stable at 115/81. The AGP Report was complete and showed a GMI of 6.9%, with glucose TIR at 79% and glucose variability of 25.8% (figure 5). These metrics met the recommended targets[2, 4, 5], and Mary continued to remain free from hypoglycaemia.

Figure 5

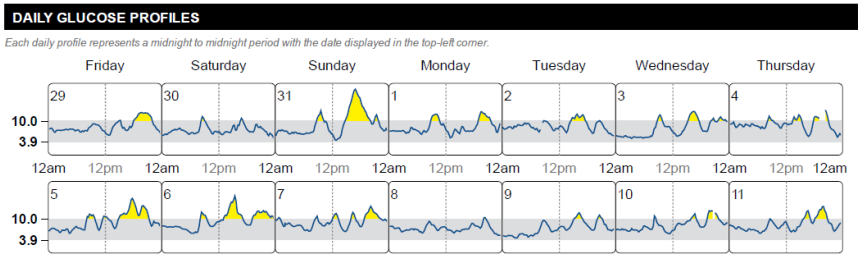


The Daily Glucose Profile report provided a quick glance across the fortnight to identify where glucose levels rose above 10.0 mmol/L, highlighted in yellow.

Mary's most recent pathology tests are yet to be taken; however, progressive review of the LibreView reports suggests her diabetes management goals are on track to being achieved.

Mary was shown how to use and access a NovoPen 6 device, as this would value-add to the information available on the LibreView reports and help her to track insulin dosing.

Figure 6



Conclusion

Use of the Libre 2 sensor changes the way diabetes is managed by both the person with diabetes and health professionals. It directs decision-making and puts the power back in the hands of the person with diabetes. Education around the benefits of optimised glycaemia and prevention of long-term complications is supported by using the AGP as a tool during discussions regarding diabetes management. Without this tool, granular analysis of how the GMI is achieved is not possible. Emerging evidence suggests that in the future, the AGP may include time in tight range (3.9–7.7 mmol/L) as an indicator to further reduce complication risk[6, 7].

The combination of metrics, used as the basis for clinical decision making, helps the NP and, in this case, Mary to discover diabetes and understand how self-determination can influence future health decisions with confidence.

References

1. Christensen S. A clinician's guide to discussing obesity with patients: Cham, Switzerland: Springer; 2021.

2. Battelino T, Danne T, Bergenstal RM, Amiel SA, Beck R, Biester T, et al. Clinical targets for continuous glucose monitoring data interpretation: recommendations from the international consensus on time in range. Diabetes Care. 2019;42(8):1593-603.

3. Kröger J, Reichel A, Siegmund T, Ziegler R. Clinical recommendations for the use of the ambulatory glucose profile in diabetes care. J Diabetes Sci Technol. 2020;14(3):586-94.

4. Beck RW, Bergenstal RM, Cheng P, Kollman C, Carlson AL, Johnson ML, Rodbard D. The relationships between time in range, hyperglycemia metrics, and HbA1c. J Diabetes Sci Technol. 2019;13(4):614-26.

5. Twigg S CN, Wischer N, Andrikopoulos S. ADS consensus position statement on: utilising the ambulatory glucose profile (AGP) combined with the glucose pattern summary to support clinical decision making in diabetes care. Sydney, New South Wales, Australia: Australian Diabetes Society; 2020. Posted 2020.

6. Hamidi V, Pettus JH. Time in tight range for patients with type 1 diabetes: the time is now, or is it too soon? Diabetes Care. 2024;47(5):782-4.

7. Beck RW, Raghinaru D, Calhoun P, Bergenstal RM. A comparison of continuous glucose monitoring-measured time-in-range 70-180 mg/dL versus time-in-tight-range 70-140 mg/dL. Diabetes Technol Ther. 2024;26(3):151-5.

Case two

Yi (Angela) Jin

Overcoming therapeutic stagnation: A culturally responsive approach to improved glycaemic control and psychological well-being in type 1 diabetes

Introduction

This case study presents the journey of a young woman named AH (pseudonym used), who had been struggling with erratic glycaemic control and significant psychological distress due to her type 1 diabetes for 10 years.

AH is a 35-year-old female originally from Southeast Asia, who arrived in Australia a few years ago after spending a decade in a refugee camp. She is currently living with her husband, children, and her mother in Brisbane. AH faces significant socioeconomic barriers, including limited social and economic support, low health literacy, and difficulty navigating her diabetes management effectively. Despite enduring efforts from her and primary healthcare providers, her condition showed limited improvement. Referred by her general practitioner (GP), an urgent review provided by the tertiary hospital diabetes clinic, where a multidisciplinary team, including endocrinologists, CDEs, and accredited practicing dietitians, integrated to provide individualised and culturally sensitive diabetes care.

Assessment

During a co-consultation with the MDT and an interpreter, the diabetes educator conducted an initial assessment to gain insights into AH's medical history, medication adherence, diabetes self-management knowledge, physical activities, and psychosocial factors. Current treatment for type 1 diabetes: Optisulin (SoloStar pen) 30 units in the morning; NovoRapid (FlexPen) 4u before each meal with correction dose prescribed.

The assessment revealed the following issues:

- Medical history: chronic kidney disease in the setting of congenital single kidney with established microvascular complication of albuminuria[1].
- Initial HbA1C was 10.1% in November 2023, indicating high diabetes complication risk[1].
- Limited understanding of the pathophysiology of type 1 diabetes and treatment principles.
- Inconsistent monitoring BGLs, average fasting BGLs ranged from 10–14 mmol/L. Ketone was negative in review. Lack of awareness regarding CGM devices with NDSS subsidy, particularly those provided free of charge given her concession card status[2].
- Denied missing insulin doses; absence of lipohypertrophy at insulin injection sites.
- A medication review was conducted by contacting her local pharmacy and found that the last insulin dispensing records were in 2021, which raised concerns about the potency and efficacy of her insulin regimen.
- Lack of connection with the Burmese community. Spending days watching comedy or playing games on the phone without engaging in any routine physical activities.
- High levels of diabetes distress with depression and suicidal ideation because of her traumatic history and the challenges of managing type 1 diabetes daily.

Overall, the assessment results underscored the urgent need for interventions to address both AH's suboptimal glycaemic control and her significant psychological distress.

Management

An individualised diabetes management plan was implemented to focus on monitoring glucose levels, stabilising insulin doses, reducing AH's distress in her diabetes self-management. Efforts were made to provide culturally

sensitive and language-appropriate educational materials and resources to help her understand diabetes management.

Step one: Introducing a FreeStyle Libre 2 continuous glucose monitor and insulin pen

The FreeStyle Libre 2 plays a vital role in facilitating real-time monitoring of her glucose trends and patterns[3]. After obtaining AH's verbal consent for the Libre 2 installation, a challenge arose as her phone was not compatible with the sensor, so she used a Libre reader initially. Fortunately, her husband's phone worked with the sensor, enabling glucose data transfer to LibreView continuously. Meanwhile, a NovoPen 6 insulin pen was ordered, allowing insulin doses to be uploaded to her LibreLink account via her husband's phone in the future[4].

Despite the initial challenge, AH received hands-on support and guidance from the diabetes educator to ensure proper sensor application and continuous glucose monitoring. The Libre application process is designed to be user-friendly, suitable for individuals with varying levels of health literacy[3]. It uses numerical data and icon signs, making it straightforward to understand and use[5].

Step two: Analysing Libre 2 AGP Report

Upon reviewing the Libre 2 data after two weeks, a concerning trend emerged as subsequent glucose readings consistently remained above 14 mmol/L throughout the day and night, despite a slight drop postprandially (figure 1). To address this issue and prevent the risk of diabetes ketoacidosis and hospital admission, an urgent clinical review was conducted with AH, facilitated by a phone interpreter.

The AGP report revealed an average glucose level of 17.9 mmol/L, low glucose variability, only 1% time in range (TIR), and 79% classified as very high. Additionally, the report highlighted a pattern of above-target median glucose values. This comprehensive analysis allowed for the identification of her high baseline glucose levels and the ineffectiveness of the mealtime NovoRapid dose.

Furthermore, the APG report illustrated her high and low alarm settings, preventing adverse events that required immediate attention and intervention. Ultimately, the AGP Report provided a detailed overview of glycaemic patterns, alerting the potential issues in AH's diabetes care.

Step three: Insulin titration

AH's insulin carbohydrate ratio (ICR) and correction factors were evaluated practically using a hospital-supplied sandwich as a standardised carbohydrate source. She counted the carbohydrates in the sandwich with assistance and administered her new prescribed NovoRapid dose of 6 units accordingly on 31 January 2024. Following the injection, her glucose readings were remotely monitored via Libre during a four-hour period. Remarkably, her sensor glucose levels (SGLs) decreased significantly from 17 mmol/L to 5.7 mmol/L within the four-hour period (figure 2), confirming the efficacy of the administered NovoRapid dose based on an ICR of 10g and a target glucose level of 8 mmol/L.

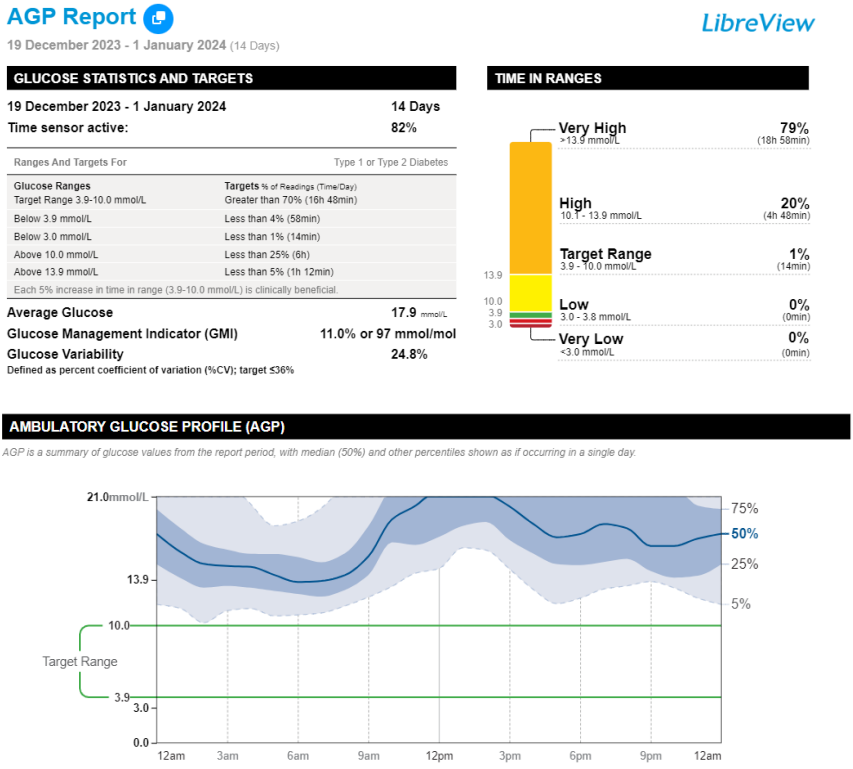
Given that the hospital insulin stock produced the expected drop in glucose levels, concerns were raised about the possibility of expired or compromised insulin at her home. AH was informed to use the new NovoRapid insulin pen at home, a similar trend of decreasing SGLs was observed on her glucose pattern on 1 February 2024. Therefore, following a discussion with AH and her endocrinologist, she needed to replace the current insulin stocks at home immediately to correct the persistent hyperglycaemia. By closely monitoring her new glucose patterns for the next 3 weeks, AH reached her first target range of 78% in February 2024 (figure 3). She experienced more than 50% reduction in insulin requirements. The reduction of her insulin dose slightly alleviated her financial stress, resulting in less expenditure on insulin daily. Her new insulin regimen consists of Optisulin 12 units in the morning and NovoRapid 2–3 units with meals, along with a correction factor rate of 3 mmol/L.

Step four: Education revision and referral to psychology review

All educational materials were carefully designed and adapted to her health literacy level[5], such as using pictorial instructions with numbers for insulin

dosage, video demonstrations for insulin subcutaneous injection techniques, ketone monitoring, diabetic ketoacidosis prevention, and hypoglycaemia treatment. Acute psychologist review and ongoing counselling sessions were provided to help AH cope with her emotional stress of living with type 1 diabetes and empower her to build up resilience and psychological well-being[6].

Figure 1



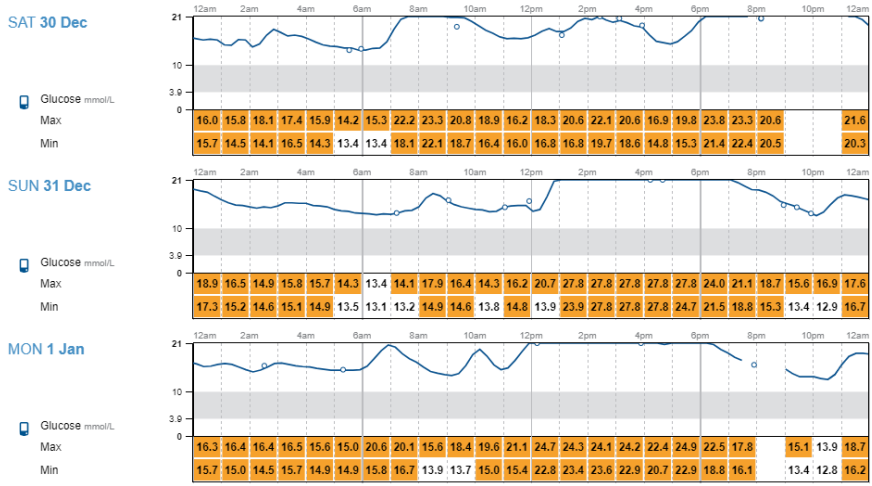
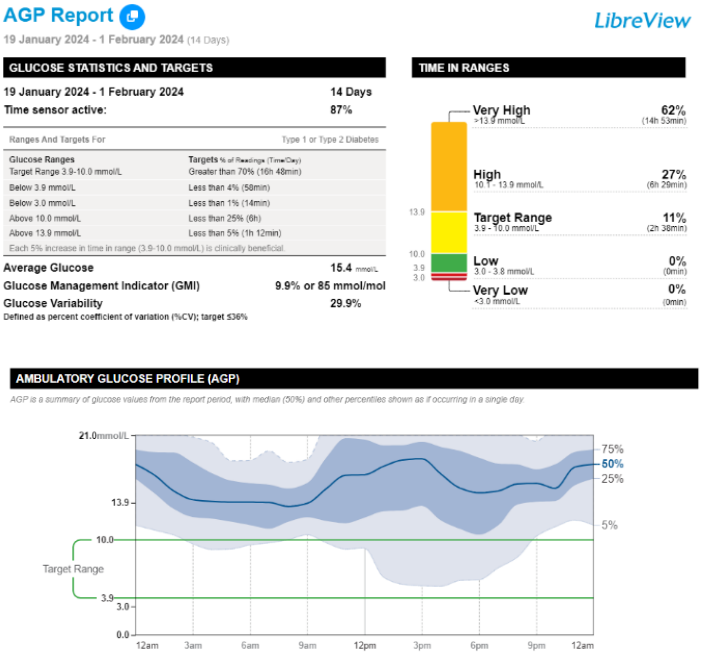

SAT 30 Dec
SUN 31 Dec
MON 1 Jan
Glucose mmol/L
Max
Min
12am 2am 4am 6am 8am 10am 12pm 2pm 4pm 6pm 8pm 10pm 12am
21
10
3.9
0
16.0 15.8 18.1 17.4 15.9 14.2 15.3 22.2 23.3 20.8 18.9 16.2 18.3 20.6 22.1 20.6 16.9 19.8 23.8 23.3 20.6 21.6
15.7 14.5 14.1 16.5 14.3 13.4 13.4 18.1 22.1 18.7 16.4 16.0 16.8 16.8 19.7 18.6 14.8 15.3 21.4 22.4 20.5 20.3
18.9 16.5 14.9 15.8 15.7 14.3 13.4 14.1 17.9 16.4 14.3 16.2 20.7 27.8 27.8 27.8 27.8 27.8 24.0 21.1 18.7 15.6 16.9 17.6
17.3 15.2 14.6 15.1 14.9 13.5 13.1 13.2 14.9 14.6 13.8 14.8 13.9 23.9 27.8 27.8 27.8 24.7 21.5 18.8 15.3 13.4 12.9 16.7
16.3 16.4 16.4 16.5 15.6 15.0 20.6 20.1 15.6 18.4 19.6 21.1 24.7 24.3 24.1 24.2 22.4 24.9 22.5 17.8 15.1 13.9 18.7
15.7 15.0 14.5 15.7 14.9 14.9 15.8 16.7 13.9 13.7 15.0 15.4 22.8 23.4 23.6 22.9 20.7 22.9 18.8 16.1 13.4 12.8 16.2

Figure 2


AGP Report
19 January 2024 - 1 February 2024 (14 Days)
LibreView
GLUCOSE STATISTICS AND TARGETS
19 January 2024 - 1 February 2024 14 Days
Time sensor active: 87%
Ranges And Targets For Type 1 or Type 2 Diabetes
Glucose Ranges
Target Range 3.9-10.0 mmol/L
Targets % of Readings (Time/Day)
Greater than 70% (16h 48min)
Below 3.9 mmol/L Less than 4% (58min)
Below 3.0 mmol/L Less than 1% (14min)
Above 10.0 mmol/L Less than 25% (6h)
Above 13.9 mmol/L Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial
Average Glucose 15.4 mmol/L
Glucose Management Indicator (GMI) 9.9% or 85 mmol/mol
Glucose Variability 29.9%
Defined as percent coefficient of variation (%CV); target ≤36%
TIME IN RANGES
Very High >13.9 mmol/L 62% (14h 53min)
High 10.1 - 13.9 mmol/L 27% (6h 29min)
Target Range 3.9 - 10.0 mmol/L 11% (2h 38min)
Low 3.0 - 3.8 mmol/L 0% (0min)
Very Low <3.0 mmol/L 0% (0min)
13.9
10.0
3.9
3.0
AMBULATORY GLUCOSE PROFILE (AGP)
AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.
21.0mmol/L
13.9
10.0
Target Range
3.9
3.0
0.0
12am 3am 6am 9am 12pm 3pm 6pm 9pm 12am
75%
50%
25%
5%

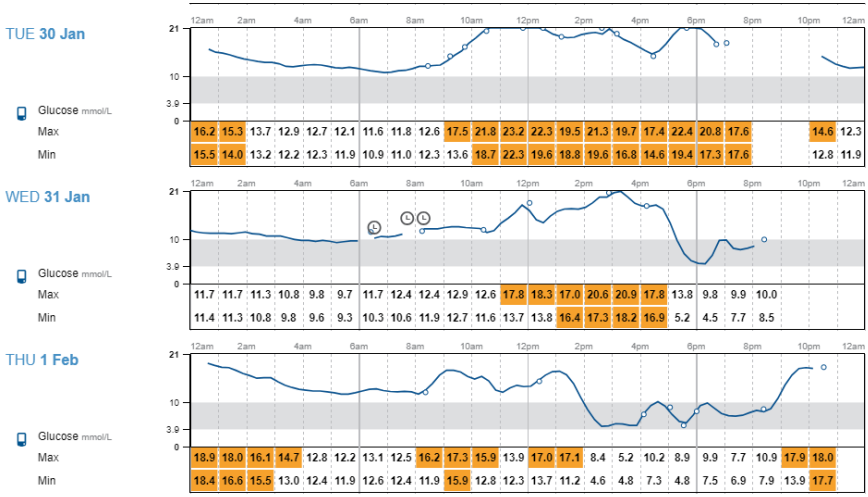


Figure 3

17 February 2024 - 1 March 2024 (14 Days)

GLUCOSE STATISTICS AND TARGETS

17 February 2024 - 1 March 2024	**14 Days**
Time sensor active:	**97%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 3.9-10.0 mmol/L	Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)

Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Average Glucose	**7.3** mmol/L
Glucose Management Indicator (GMI)	**6.5% or 47 mmol/mol**
Glucose Variability	**38.2%**

Defined as percent coefficient of variation (%CV); target ≤36%

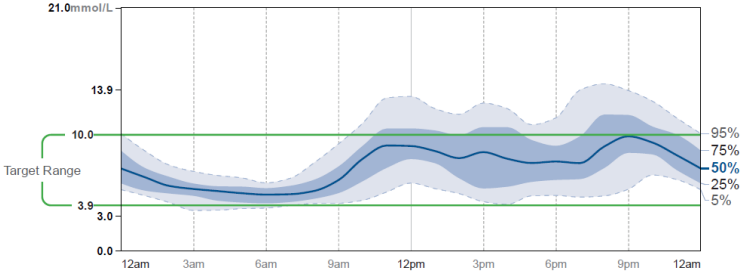
TIME IN RANGES

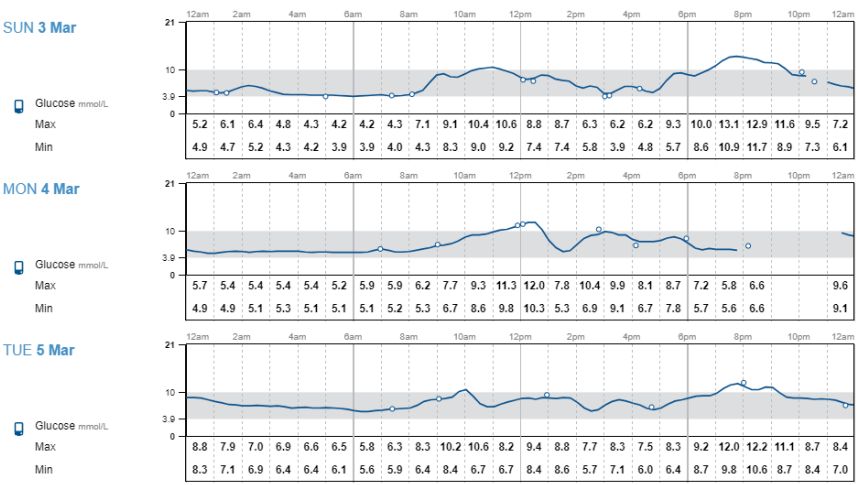
Very High	>13.9 mmol/L	2% (29min)
High	10.1 - 13.9 mmol/L	17% (4h 5min)
Target Range	3.9 - 10.0 mmol/L	78% (18h 43min)
Low	3.0 - 3.8 mmol/L	3% (43min)
Very Low	<3.0 mmol/L	0% (0min)

13.9
10.0
3.9
3.0

AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.





Management outcomes:

- AH's glycaemic management significantly improved with the newly updated insulin, as shown by a decrease in her average glucose levels and GMI from 11% to 6.5%. By enabling timely adjustments to her insulin regimen based on Libre data, the technology contributed to significant improvements in her glycemic control and empowered her to make informed decisions about her daily activities[3]. It allowed for a more flexible lifestyle as it provided insights about how traditional diet, physical activities, and emotional stress impact glucose levels.
- Using the low and high alarms prevented the risk of hyperglycaemia-related complications and improved the overall safety of the patient's diabetes management, improving her sleep quality and reducing the stress of hyperglycaemia or hypoglycaemia.
- AH's psychological well-being experienced a marked improvement, evident by her reduced depressive symptoms and the cessation of suicidal ideation. This positive change in mental health was a crucial aspect of her overall well-being[6].

Conclusion

This case study highlights the significance of addressing not only the medical aspects but also the cultural and linguistic considerations in diabetes management. By adopting an individualised education approach and providing culturally sensitive care, healthcare providers can empower patients to manage their diabetes better and improve their overall well-being[7].

The integration of FreeStyle Libre 2 played a crucial role in unravelling the complexities of AH's diabetes management journey and optimising her therapeutic outcomes. During the investigation phase to assess the efficacy of her insulin regimen, CGM provided real-time insights about her glucose levels, enabling healthcare providers to monitor her response to insulin dosing accurately[3]. By analysing CGM data, it was determined that the issue did not lie in the need for higher insulin doses but rather in the potency of the insulin itself, as evidenced by the significant drop in SGLs following the administration of NovoRapid.

Overall, the Libre technology has significantly reduced the burden of AH's diabetes management and enhanced her overall quality of life. AH's smile at the end of the consultation was the best feedback about the diabetes education provided, indicating that the improvements in her glycaemic control and quality of life were significant and meaningful to her.

References

1. Tecilazich F, editor. Microvascular disease in diabetes. Wiley-Blackwell; 2020.

2. National Diabetes Services Scheme (NDSS). Access CGM and Flash GM. Accessed March 10, 2024. https://www.ndss.com.au/about-the-ndss/changes-to-the-ndss/

3. Evans M, Welsh Z, Ells S, Seibold A. The impact of flash glucose monitoring on glycaemic control as measured by HbA1c: a meta-analysis of clinical trials and real-world observational studies. *Diabetes Ther*. 2020;11(1):83-95. doi:10.1007/s13300-019-00720-0

4. Abbott Diabetes Care. NovoPen 6 and the FreeStyle LibreLink app. Accessed March 10, 2024. https://www.FreeStylelibre.com.au/novopen

5. Misra R, Adelman MM, Kirk B, Sambamoorthi U. Relationship among diabetes distress, health literacy, diabetes education, patient-provider communication and diabetes self-care. *Am J Health Behav*. 2022; 46(5):528-40. doi:10.5993/AJHB.46.5.4

6. Ashraf MN, Cheng AY, Robinson DJ. Emotional, Psychological, and Social Well-being Experience of Long-Term Living with Type 1 Diabetes Mellitus: A Patient–Psychiatrist–Endocrinologist Perspective. *Diabetes Ther*. 2024; 15 (2): 317–23. doi:10.1007/s13300-023-01527-w

7. Smythe K, Siddiqui N, Sidhu B, Simmons D, Flack J, Wong V. Challenges associated with integrating care for people from culturally and linguistically diverse backgrounds who have diabetes. *Int J Integr Care.* 2019;19(4):326. doi:10.5334/ijic.s3326

Case three

Rachel McKeown

Curbing carers' concerns — FreeStyle living for support people of the person living with diabetes

Introduction

The person in this case study has type 2 diabetes requiring insulin, and she will be referred to as Mrs N.

Mrs N is 70 years old and lives with her husband. Both are retired. They have children and grandchildren who live some hours away and visit during holiday periods. Mrs N enjoys gardening and painting, and swimming in her plunge pool during summer.

Mrs N has multiple health conditions requiring the assistance of a large multidisciplinary team including her GP, endocrinologist, cardiologist, dermatologist, ophthalmologist, podiatrist, and urologist.

Mrs N self-referred to me, the sole diabetes educator in our local health district, for ongoing diabetes self-management education and support and case management. I am also a dietitian. My role is diabetes educator for inpatients and outpatients in our area of around 12,000 people.

Mr and Mrs N are both well-educated on diabetes management and eager to continue to learn as treatments and technology change. Mr N is a great support to his wife, and both recognise that this can also be taxing on him. They have moved from Sydney in the past year and are looking to have their diabetes educator regularly review Mrs N's diabetes management and be a support person for her health and general well-being.

This case study describes the use of the FreeStyle Libre 2 CGM and associated reports with AGP to improve the clinical outcomes for Mrs N, and the emotional wellbeing for both Mrs and Mr N.

Assessment

Upon initial assessment, Mrs N described her multiple health conditions including asthma, sleep apnoea, dermatitis, urinary incontinence — for which she receives Botox injections — and shoulder bursitis — for which she has regular cortisone injections. She has regular breast checks and foot checks. She currently has oral thrush and has recently undergone cataract surgery.

Her insulin regimen is made up of Optisulin (80 units nocte), and Fiasp (20 units with main meals). Mrs N is comfortable to administer supplemental Fiasp as required if her glucose levels are elevated.

- Weight: 119 kg
- Height 170 cm
- BMI: 41.2

Mrs N has broken sleep due to pain and sleep apnoea. She often sleeps in her armchair in the lounge room as she finds this more comfortable. Her general movement is slow, she uses a walking stick, and she tries to swim or garden a couple of times per day as she's aware about the benefits of physical activity.

Mr N has concerns for his wife, mainly being her weight and diabetes management as these are affecting a lot of her other health conditions. He also recognises the carer burden placed on him.

Discussion regarding CGM occurred as the couple had heard of these devices being available and felt they would like to try them. The benefits of the Libre 2 system were discussed as: fortnightly wear; readable from both Mrs N's phone as well as Mr N's; alerts and alarms for low and high glucose readings; and eliminating the need for finger checks on Mrs N's fingers.

Management

During the initial visit, we initiated the Libre 2 sensor, FreeStyle LibreLink App and LibreLinkUp App.

Education also included carbohydrate sources and amounts, meal planning, physical activity effects on glucose levels, hypoglycaemia awareness and treatment, and self-adjustment of insulin. Carbohydrate manipulation and insulin requirements effect on weight management were also discussed, with the aim of reducing Mrs N's weight to assist other co-morbidities, such as sleep apnoea, and movement limitations.

At our first review two weeks later, the LibreView report was accessed and discussed (attachment 1).

We used the AGP Report, Glucose Pattern Insights, as well as the Daily Log to reflect on management goals and discuss next steps. The AGP Report showed that TIR was 38% with the GMI at 8.3%. We discussed targets and moving these figures towards the targets gradually over time, with the consideration of Mrs N's other comorbidities and age. With the average glucose level sitting at 11.5 mmol/L, both Mrs and Mr N were certain they wanted to improve this.

The Daily Log helped provide insights about daily activities around glucose management, including amounts of insulin taken and some notes being recorded. Both Mrs and Mr N agreed that these features were extremely helpful in remembering what had happened during the past two weeks. Being able to record the events and reflect provided much mental relief in contrast to the pressure of having to try and recall such information. We used the Daily Log to discuss the changes to insulin doses that Mrs N had made, including as she noticed her glucose levels rising overnight, her self-dose adjustment of Optisulin up to 90units. She was happy that this appeared to help her glucose levels particularly overnight and upon waking. She was also extremely happy that she was confident to do this, knowing the alarms were set to alert her to a hypoglycaemic episode if that were to occur.

The biggest advantage felt by Mrs N and Mr N was the decreased strain on their relationship as husband and wife. They both reflected on how much less stress there was between them. Mr N was no longer enquiring about Mrs N to check her BGLs as he could see them on his phone, and Mrs N felt a lot less 'nagged' to be monitoring her BGLs. They were both a lot happier and positive about Mrs N's diabetes management.

With new-found confidence, we set a review appointment for another two weeks' time, and Mrs N's goal to increase her TIR, and reduce her GMI and average glucose.

At our next review, we used the same aspects of the LibreView report to discuss Mrs N's glucose management. Mrs N was ecstatic to see the parameters to had improved, with TIR now 53%, GMI 7.6% and average glucose 10mmol/L (attachment 2). Again, we reviewed the Daily Log pages of the report to discuss insulin doses and glucose patterns. She had remained on 90 units of Optisulin and this was working well. We were able to discuss the hypoglycaemia events and the apparent spikes in glucose levels after breakfast. We discussed carbohydrate foods and Mrs N reported she continued to work on appropriate and consistent portion sizes. These discussions again motivated Mrs N to modify and try different options for breakfast and self-adjust insulin doses for lunch and dinner. She continued to use the notes section to easily mark doses of insulin and make notes when she felt appropriate to jog her memory for our review.

Mrs N also reported a happier disposition in that she had returned to more gardening, more painting, and better sleep. Her weight had decreased to 116kg.

There continued to be apparent confidence and motivation in Mrs N's discussions regarding her diabetes management. Further, Mr N continued to praise the Libre 2 system for the contentment they were both feeling, and the ease of use in being able to modify diet and exercise and have immediate feedback through the continued glucose monitoring system.

Over the next six months, Mrs N and Mr N continued to return for review every four to six weeks. We continued to review diabetes management and discuss diet, exercise, insulin doses and overall well-being. The AGP Reports over the past six months (attachment 3) continue to show improvements in TIR, GMI, and average glucose with minimal hypoglycaemia events. Mrs N's weight is now 110 kg.

Conclusion

The AGP Plus reports have been shared with Mrs N's GP and endocrinologist, and Mrs N has been able to discuss improvements in her diabetes management and overall health and wellbeing with the other members of her healthcare team. This has included the great improvement in her mental health, motivation, and confidence in managing not only her diabetes, but all aspects of her health and comorbidity symptoms and conditions. She is feeling positive and energetic toward maintaining lifestyle changes into the future as she has instant gratification from her efforts in her diabetes management. The reports have also provided a point of discussion for her GP and endocrinologist whereby they too have been able to adjust other medications (such as for blood pressure), review Mrs N's self-adjustment of insulin doses, and encourage her lifestyle changes.

The impact to Mr N's wellbeing and mental health has also been notable. He expressed numerous advantages for himself relating to his wife wearing the Libre 2 sensor. These advantages include better sleep, less stress, decreased feeling like he was always questioning Mrs N about her diabetes management, decreased worry and concern regarding hyperglycaemia and hypoglycaemia events, and increased contentment and confidence that her diabetes management was going OK. His relief at having one less health concern to constantly worry about for her was evident.

The large impact I have witnessed on Mr N's quality of life has changed the way I now discuss Libre 2 use with others, noting the potential advantages for not only the person with diabetes, but their family, friends and carers as well.

Attachment 1

AGP Report

25 September 2023 - 8 October 2023 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

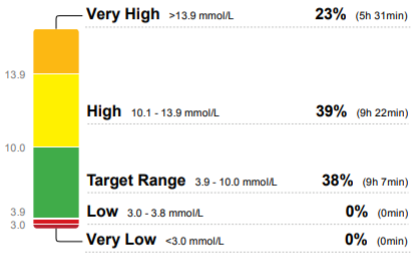
25 September 2023 - 8 October 2023	**14 Days**
Time Sensor Active:	**97%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 3.9-10.0 mmol/L	Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

Average Glucose	**11.5** mmol/L
Glucose Management Indicator (GMI)	**8.3% or 67 mmol/mol**
Glucose Variability	**29.6%**

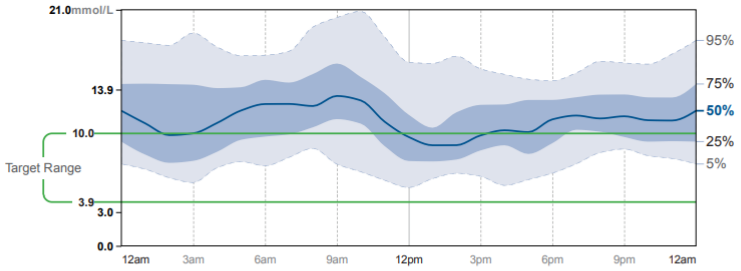
Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



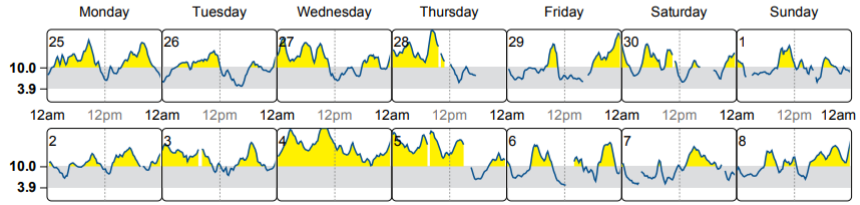
AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



DAILY GLUCOSE PROFILES

Each daily profile represents a midnight to midnight period with the date displayed in the upper left corner.



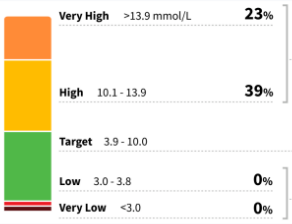
Source: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American Diabetes Association, 7 June 2019, https://doi.org/10.2337/dci19-0028.

Glucose Pattern Insights

Selected Dates: 25 Sep - 8 Oct 2023 (14 Days)

Time Sensor Active: 97%

Time in Ranges



Glucose Statistics

Average Glucose

11.5 mmol/L Goal: ≤8.6 mmol/L

Glucose Management Indicator (GMI)

Approximate A1C level based on average CGM glucose level.

8.3% Goal: ≤7.0% | 67 mmol/mol Goal: ≤53 mmol/mol

Considerations for the Clinician[1]

Most Important Pattern: Highs Overnight, All Day

Medication

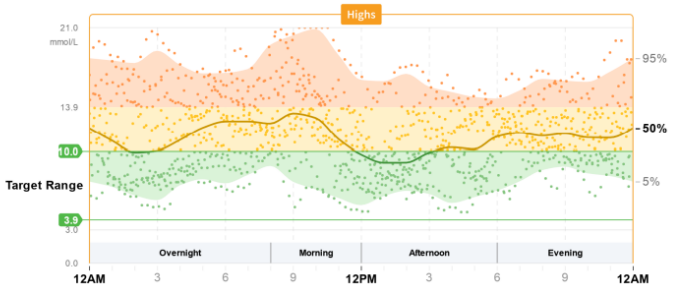
- For T1 patients, consider adjusting insulin
- For T2 patients currently taking insulin or sulfonylurea, consider adjusting medication
- For other T2 patients, consider starting a new medication such as insulin

Lifestyle

Highs are often associated with high glucose variability. The following behaviors may contribute to glucose variability:

- Medication sometimes missed?
- Meals or snacks sometimes high in carbohydrates?

Glucose Patterns (14 Days)



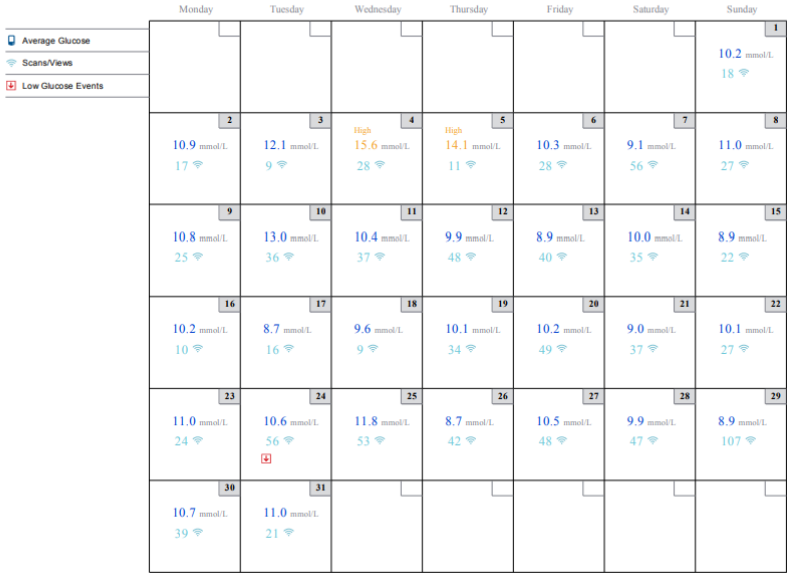
Device(s): FreeStyle Libre link +

1. Suggested considerations do not replace the opinion or advice of the healthcare provider.

Monthly Summary

October 2023

LibreView

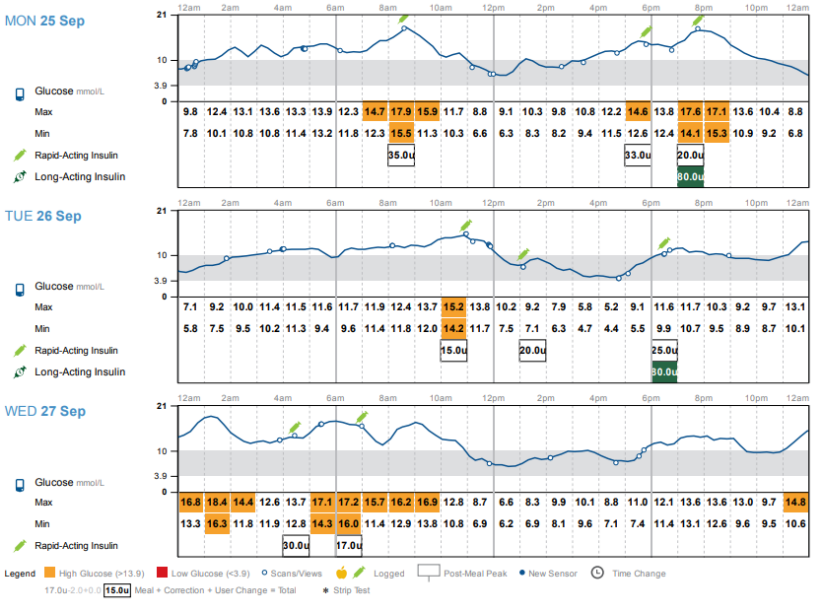


SOURCES: FreeStyle LibreLink + 2

Daily Log

LibreView

25 September 2023 - 8 October 2023 (14 Days)

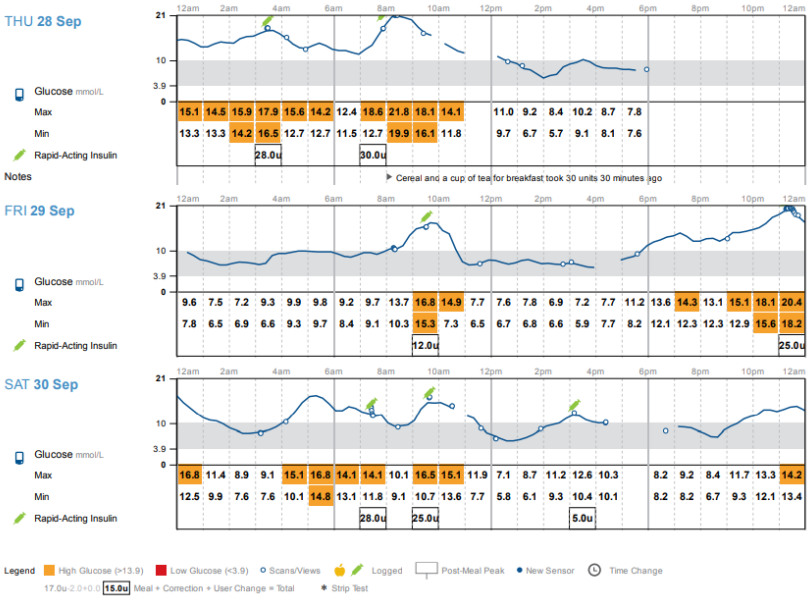


SOURCES: FreeStyle LibreLink +

Daily Log

LibreView

25 September 2023 - 8 October 2023 (14 Days)



Legend High Glucose (>13.9) Low Glucose (<3.9) Scans/Views Logged Post-Meal Peak New Sensor Time Change

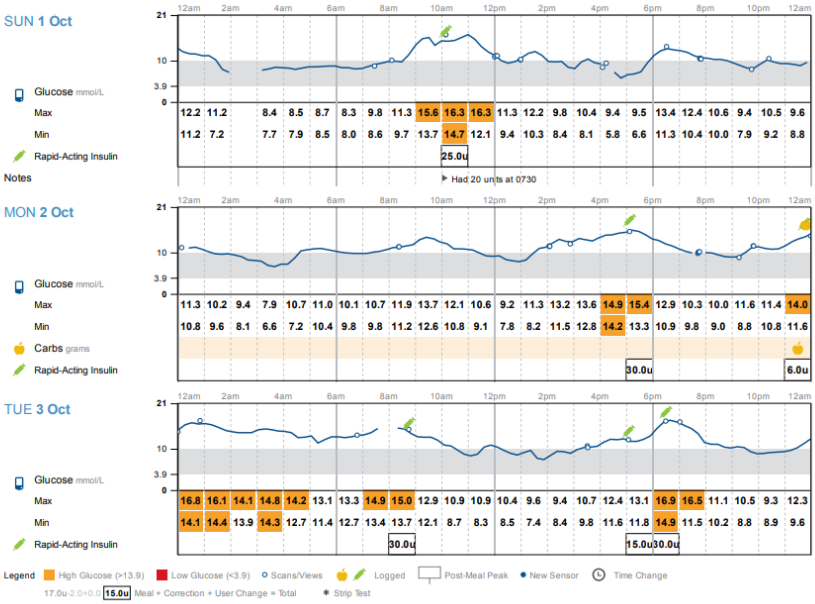
17.0u-2.0+0.0 **15.0u** Meal + Correction + User Change = Total Strip Test

SOURCES FreeStyle LibreLink + 2

Daily Log

25 September 2023 - 8 October 2023 (14 Days)

LibreView

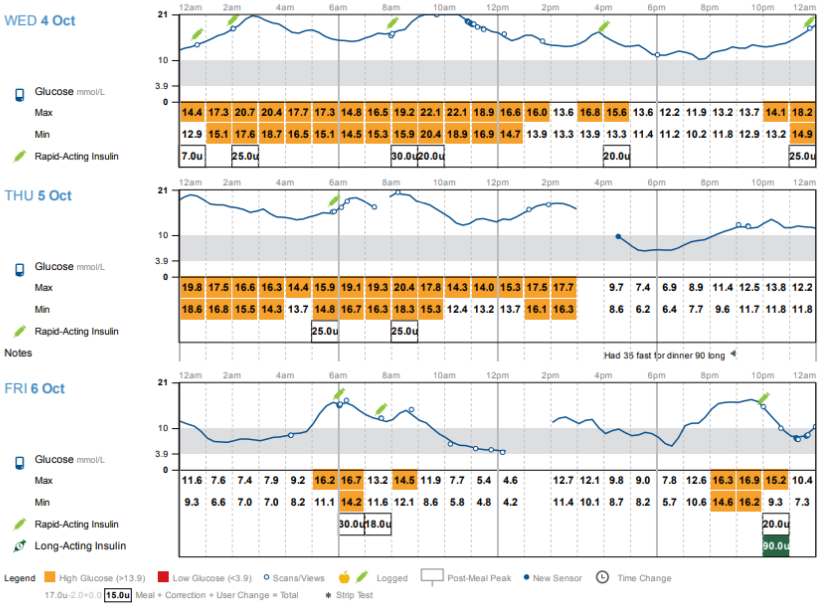


SOURCES FreeStyle LibreLink + 2

Daily Log

LibreView

25 September 2023 - 8 October 2023 (14 Days)



SOURCES: FreeStyle LibreLink + NZ

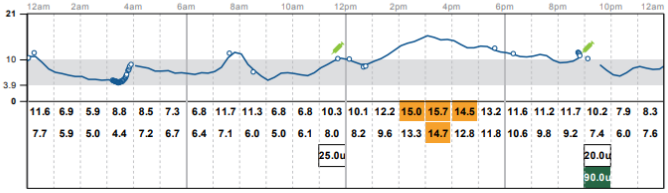
Daily Log

LibreView

25 September 2023 - 8 October 2023 (14 Days)

SOURCES FreeStyle Libre Link + 2

SAT 7 Oct

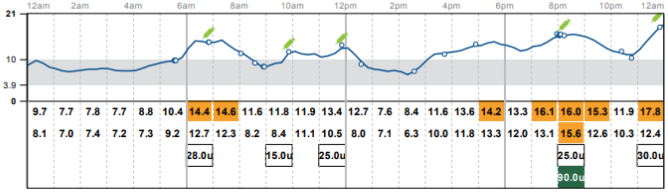


Glucose mmol/L																							
Max	11.6	6.9	5.9	8.8	8.5	7.3	6.8	11.7	11.3	6.8	6.8	10.3	10.1	12.2	15.0	15.7	14.5	13.2	11.6	11.2	11.7	10.2	7.9	8.3
Min	7.7	5.9	5.0	4.4	7.2	6.7	6.4	7.1	6.0	5.0	6.1	8.0	8.2	9.6	13.3	14.7	12.8	11.8	10.6	9.8	9.2	7.4	6.0	7.6
Rapid-Acting Insulin												25.0u										20.0u		
Long-Acting Insulin																						90.0u		

Notes

Had 30 at dinner

SUN 8 Oct



Glucose mmol/L																							
Max	9.7	7.7	7.8	7.7	8.8	10.4	14.4	14.6	11.6	11.8	11.9	13.4	12.7	7.6	8.4	11.6	13.6	14.2	13.3	16.1	16.0	15.3	11.9	17.8
Min	8.1	7.0	7.4	7.2	7.3	9.2	12.7	12.3	8.2	8.4	11.1	10.5	8.0	7.1	6.3	10.0	11.8	13.3	12.0	13.1	15.6	12.6	10.3	12.4
Rapid-Acting Insulin							28.0u			15.0u		25.0u									25.0u			30.0u
Long-Acting Insulin																					90.0u			

Legend High Glucose (>13.9) Low Glucose (<3.9) Scans/Views Logged Post-Meal Peak New Sensor Time Change

17.0u-2.0+0.0 **15.0u** Meal + Correction + User Change = Total * Strip Test

Snapshot

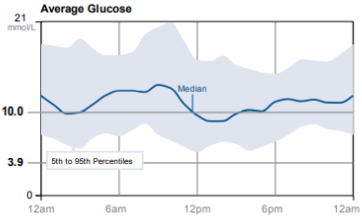
LibreView

25 September 2023 - 8 October 2023 (14 Days)

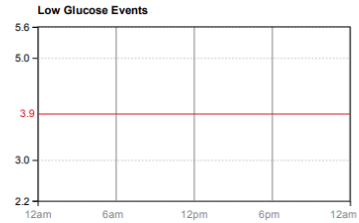
Glucose

GMI **8.3**% or **67** mmol/mol

AVERAGE GLUCOSE	**11.5** mmol/L
% above target	**62** %
% in target	**38** %
% below target	**0** %

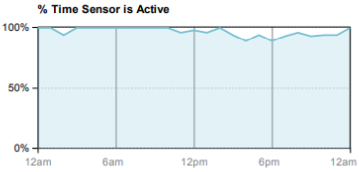


LOW GLUCOSE EVENTS	**0**
Average duration	**0** Min



Sensor Usage

% TIME SENSOR IS ACTIVE	**97** %
Average scans/views	**23 / Day**



Carbs

DAILY CARBS	- grams/day

INSULIN

RAPID-ACTING INSULIN	**64.1** units/day
LONG-ACTING INSULIN	**30.7** units/day
Total Daily Insulin	**94.8** units/day

Comments

• Gaps found in food data. 14 days in this reporting period have no recorded food events.

SOURCES FreeStyle LibreLink +2

Attachment 2

AGP Report

MRN: _____

DEVICE: FreeStyle LibreLink +

LibreView

9 October 2023 - 22 October 2023 (14 Days)

GLUCOSE STATISTICS AND TARGETS

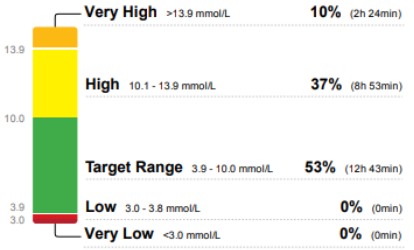
9 October 2023 - 22 October 2023	**14 Days**
Time Sensor Active:	**98%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 3.9-10.0 mmol/L	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

Average Glucose	**10.0** mmol/L
Glucose Management Indicator (GMI)	**7.6% or 60 mmol/mol**
Glucose Variability	**29.0%**

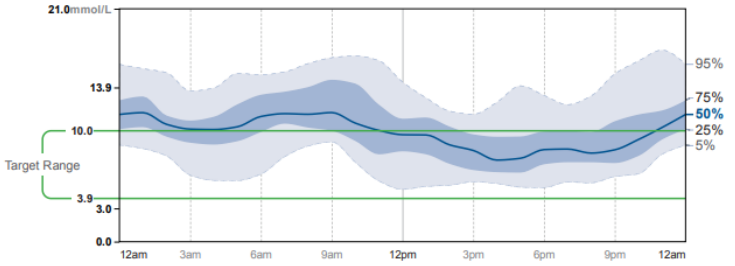
Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



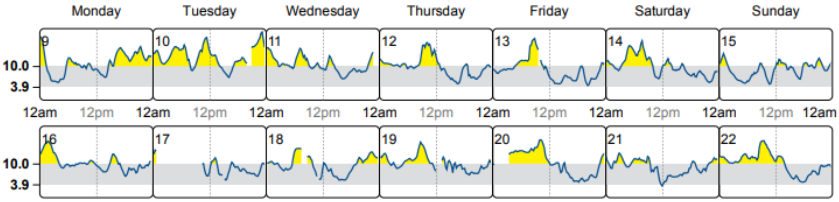
AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



DAILY GLUCOSE PROFILES

Each daily profile represents a midnight to midnight period with the date displayed in the upper left corner.



Source: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American Diabetes Association, 7 June 2019, https://doi.org/10.2337/dci19-0028.

Glucose Pattern Insights

LibreView

Selected Dates: 9 Oct - 22 Oct 2023 (14 Days)

Time Sensor Active: 98%

Time in Ranges

Very High	>13.9 mmol/L	10%	47% Goal: <25%
High	10.1 - 13.9	37%	
Target	3.9 - 10.0	53%	>70%
Low	3.0 - 3.8	0%	0% <4%
Very Low	<3.0	0%	

Glucose Statistics

Average Glucose

10.0 mmol/L Goal: ≤8.6 mmol/L

Glucose Management Indicator (GMI)

Approximate A1C level based on average CGM glucose level.

7.6% Goal: ≤7.0% | 60 mmol/mol Goal: ≤53 mmol/mol

Considerations for the Clinician[1]

Most Important Pattern: Highs Overnight, Morning, Evening

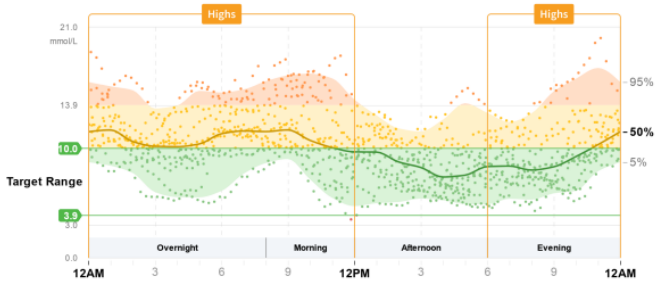
Medication

- For T1 patients, consider adjusting insulin
- For T2 patients currently taking insulin or sulfonylurea, consider adjusting medication
- For other T2 patients, consider starting a new medication such as insulin

Lifestyle

- Meals or snacks often high in carbohydrates?

Glucose Patterns (14 Days)



Device(s): FreeStyle LibreLink +

1. Suggested considerations do not replace the opinion or advice of the healthcare provider.

Monthly Summary

October 2023

LibreView

Average Glucose
Scans/Views
Low Glucose Events

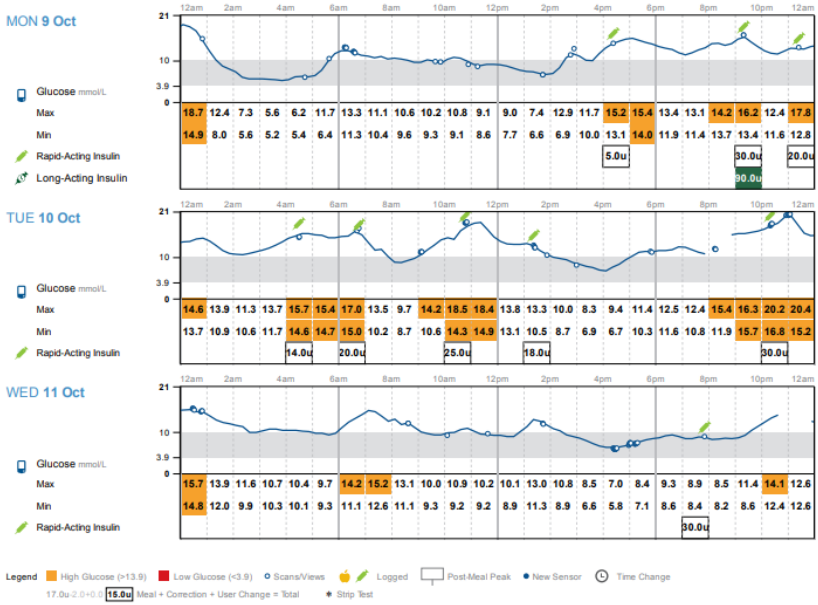
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
						1 10.2 mmol/L 18
2 10.9 mmol/L 17	3 12.1 mmol/L 9	4 High 15.6 mmol/L 28	5 High 14.1 mmol/L 11	6 10.3 mmol/L 28	7 9.1 mmol/L 56	8 11.0 mmol/L 27
9 10.8 mmol/L 25	10 13.0 mmol/L 36	11 10.4 mmol/L 37	12 9.9 mmol/L 48	13 8.9 mmol/L 40	14 10.0 mmol/L 35	15 8.9 mmol/L 22
16 10.2 mmol/L 10	17 8.7 mmol/L 16	18 9.6 mmol/L 9	19 10.1 mmol/L 34	20 10.2 mmol/L 49	21 9.0 mmol/L 37	22 10.1 mmol/L 27
23 11.0 mmol/L 24	24 10.6 mmol/L 56	25 11.8 mmol/L 53	26 8.7 mmol/L 42	27 10.5 mmol/L 48	28 9.9 mmol/L 47	29 8.9 mmol/L 107
30 10.7 mmol/L 39	31 11.0 mmol/L 21					

SOURCES: FreeStyle LibreLink +

Daily Log

LibreView

9 October 2023 - 22 October 2023 (14 Days)



SOURCES FreeStyle LibreLink + 2

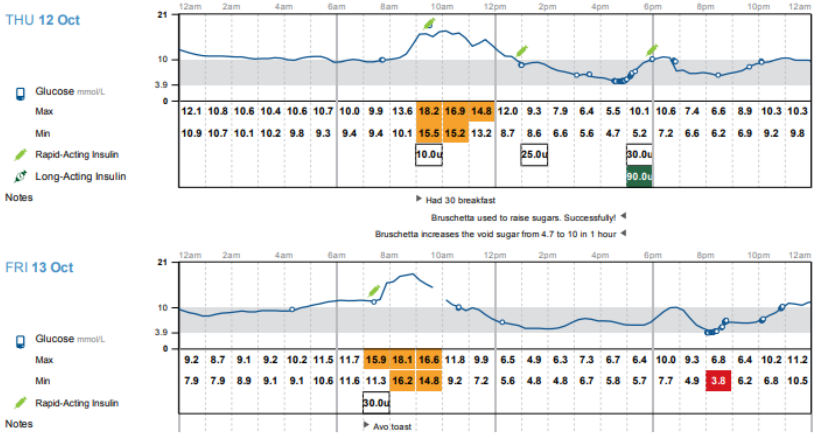
Legend High Glucose (>13.9) Low Glucose (<3.9) Scans/Views Logged Post-Meal Peak New Sensor Time Change

17.0u-2.0+0.0 15.0u Meal + Correction + User Change = Total Strip Test

Daily Log

9 October 2023 - 22 October 2023 (14 Days)

LibreView



SOURCES FreeStyle LibreLink + 2

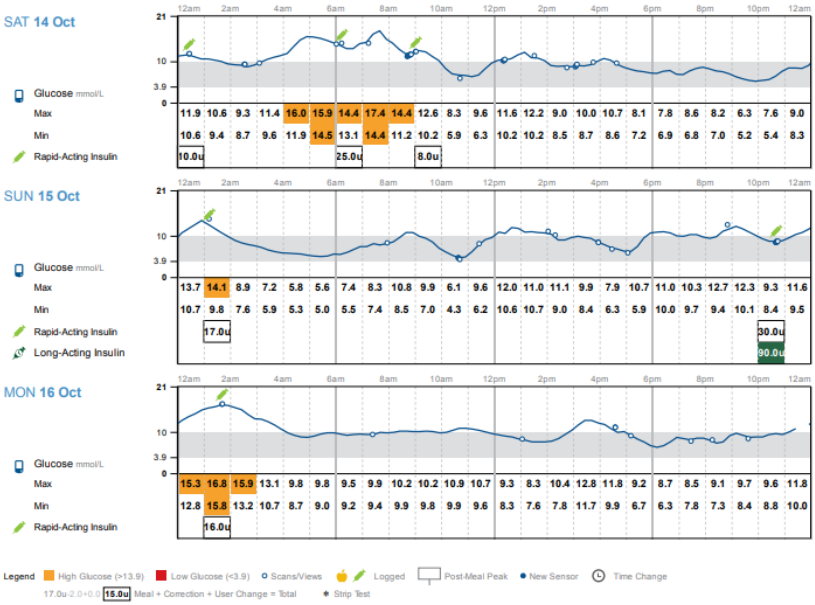
Legend High Glucose (>13.9) Low Glucose (<3.9) Scans/Views Logged Post-Meal Peak New Sensor Time Change

17.0u 2.0+0.0 15.0u Meal + Correction + User Change = Total Strip Test

Daily Log

LibreView

9 October 2023 - 22 October 2023 (14 Days)



SOURCES FreeStyle LibreLink +

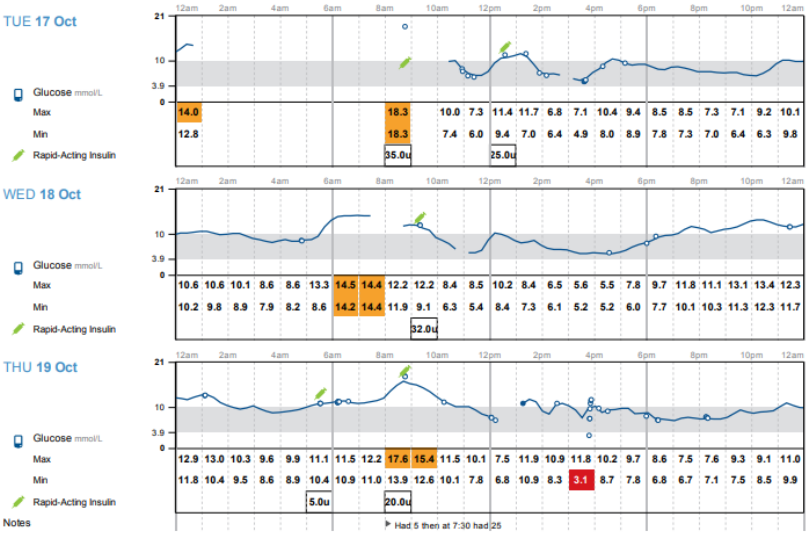
Legend High Glucose (>13.9) Low Glucose (<3.9) Scans/Views Logged Post-Meal Peak New Sensor Time Change

17.0u-2.0+0.0 15.0u Meal + Correction + User Change = Total Strip Test

Daily Log

LibreView

9 October 2023 - 22 October 2023 (14 Days)



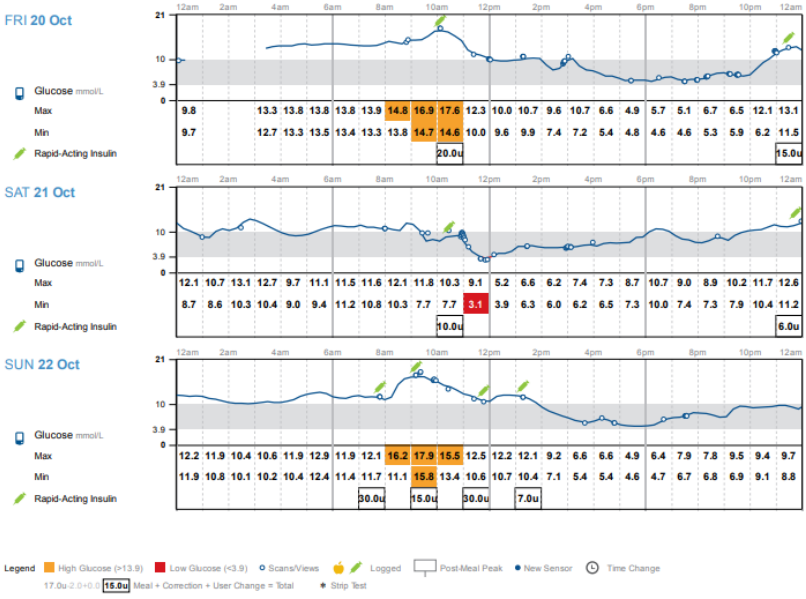
Legend High Glucose (>13.9) Low Glucose (<3.9) Scans/Views Logged Post-Meal Peak New Sensor Time Change

17.0u-2.0+0.0 **15.0u** Meal + Correction + User Change = Total Strip Test

Daily Log

LibreView

9 October 2023 - 22 October 2023 (14 Days)



Legend High Glucose (>13.9) Low Glucose (<3.9) Scans/Views Logged Post-Meal Peak New Sensor Time Change

17.0u-2.0+0.0 **15.0u** Meal + Correction + User Change = Total Strip Test

SOURCES FreeStyle LibreLink + 2

Snapshot

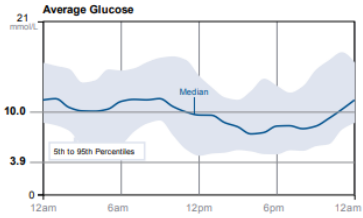
9 October 2023 - 22 October 2023 (14 Days)

LibreView

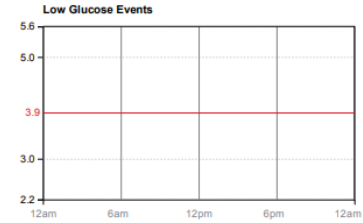
Glucose

GMI **7.6%** or **60** mmol/mol

AVERAGE GLUCOSE	**10.0** mmol/L
% above target	**48** %
% in target	**52** %
% below target	**0** %

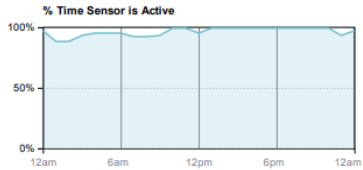


LOW GLUCOSE EVENTS	**0**
Average duration	**0** Min



Sensor Usage

% TIME SENSOR IS ACTIVE	**98** %
Average scans/views	**30 / Day**



Carbs

DAILY CARBS	grams/day

INSULIN

RAPID-ACTING INSULIN	**45.9** units/day
LONG-ACTING INSULIN	**19.3** units/day
Total Daily Insulin	**65.2** units/day

Comments

• Gaps found in food data. 14 days in this reporting period have no recorded food events.

SOURCES FreeStyle LibreLink + 2

Attachment 3

AGP Report

20 November 2023 - 3 December 2023 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

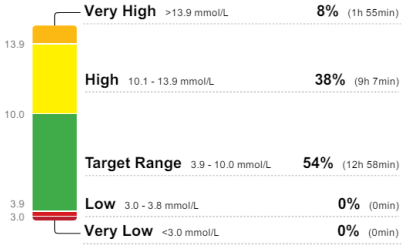
20 November 2023 - 3 December 2023	**14 Days**
Time Sensor Active:	**100%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 3.9-10.0 mmol/L	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

Average Glucose	**9.8** mmol/L
Glucose Management Indicator (GMI)	**7.5% or 59 mmol/mol**
Glucose Variability	**27.0%**

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



AGP Report

15 January 2024 - 28 January 2024 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

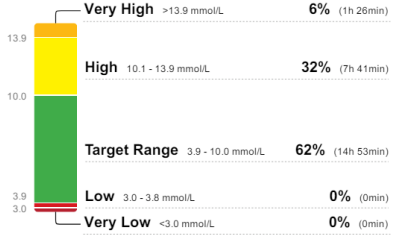
15 January 2024 - 28 January 2024	**14 Days**
Time Sensor Active:	**89%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 3.9-10.0 mmol/L	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

Average Glucose	**9.4** mmol/L
Glucose Management Indicator (GMI)	**7.3% or 57 mmol/mol**
Glucose Variability	**29.8%**

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



AGP Report

25 March 2024 - 7 April 2024 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

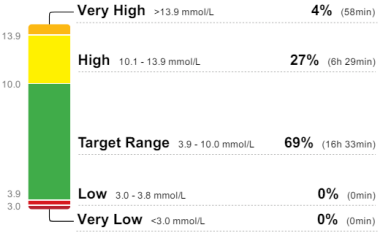
25 March 2024 - 7 April 2024	**14 Days**
Time Sensor Active:	**100%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 3.9-10.0 mmol/L	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

Average Glucose	**9.0** mmol/L
Glucose Management Indicator (GMI)	**7.2% or 55 mmol/mol**
Glucose Variability	**27.5%**

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



AGP Report

6 May 2024 - 19 May 2024 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

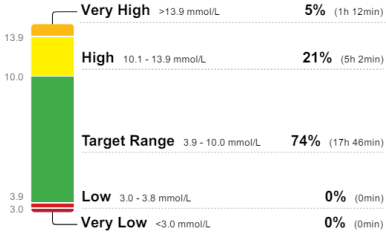
6 May 2024 - 19 May 2024	**14 Days**
Time Sensor Active:	**100%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 3.9-10.0 mmol/L	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

Average Glucose	**8.7** mmol/L
Glucose Management Indicator (GMI)	**7.1% or 54 mmol/mol**
Glucose Variability	**27.4%**

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



Case four

Beck Newton

Leveraging continuous glucose monitoring to improve type 2 diabetes management

Introduction

I'm a self-employed private practice CDE. I'm a Registered Nurse (RN) and Accredited Practising Dietitian (APD). While I work in several locations and via telehealth, I predominantly practice from a not-for-profit organisation, where I'm a contractor. The team I work with offers information, education, connection, clinical care, and wraparound social support for people living with type 1 diabetes.

This case describes Harry (pseudonym), who is a 56-year-old male diagnosed with type 2 diabetes 15 years ago. He self-referred to my clinic in mid-2022 seeking support to manage his diabetes. Harry was keen to reduce his BG, lose some weight (was 124 kg) and improve his cycling performance. He'd started eating a lower carbohydrate (low carb) diet prior to coming to see me and was seeking support from a dietitian/diabetes educator with this eating approach, while using insulin. He was interested in type 2 diabetes remission, or at least reducing his diabetes medications.

Assessment

Harry's diabetes medication was Humalog 25/75 insulin 60U BD, Janumet 50 mg BD and Amaryl 4 mg OD. He had been prescribed Ozempic but had not started due to the supply issues. His most recent HbA1c was 8.0%. He had been using a blood glucometer (BG meter) to check his BG.

He felt that he was experiencing hypoglycaemia during the night and while riding his bike, generally cycling about 200 km per week. He didn't always carry his BG meter with him while riding long distances due to the bulk. Instead, treating assumed low symptoms without really knowing what his BGLs

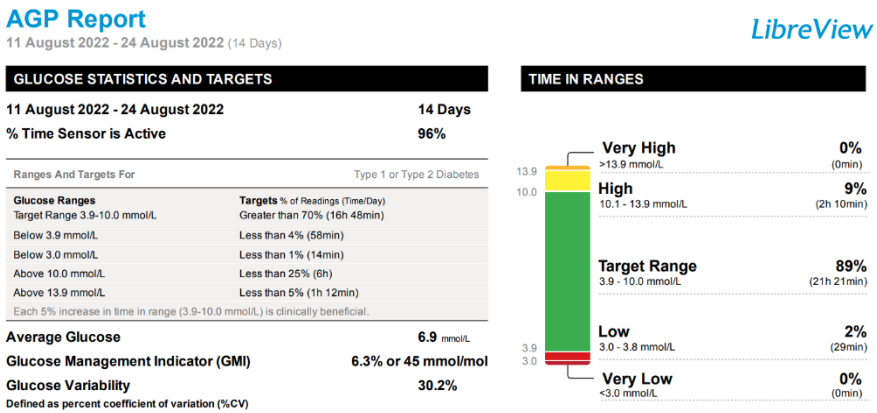
were. He would usually check his BG and treat lows at the end of his very long rides. Harry said that he often ate his hypoglycaemia treatment, jellybeans, in excess after a ride and he felt this was counterproductive to his weight loss efforts. He was also, and understandably, very anxious about having lows while out riding and during his sleep.

I provided him with information and education around a low carb eating approach for someone living with type 2 diabetes, including the precautions and monitoring required for someone using insulin. I immediately considered how a FreeStyle Libre 2 could assist Harry with this. I explained to Harry how this could capture more data than his current finger-pricking regimen, and that he'd be able to access readings using his phone while out on his bike to make more informed treatment decisions. As he was using insulin, I was able to provide him with a free sensor to trial over the following two weeks. I explained that beyond the trial, to continue using the device, he would need to privately fund it, as type 2 diabetes was ineligible for the NDSS CGM access subsidy. I helped him to set up his low alarm, which he stated would be very helpful with reducing his overnight anxiety. He was encouraged to log his food intake, insulin doses, and exercise into the LibreLink logbook so we could review his pre and postprandial glucose levels. This would allow us to assess the impact of exercise, different types of foods, and his insulin doses on his glucose levels at his next appointment two weeks later.

Management

On his first review, Harry said he had already reduced his insulin from 60U BD to 55U at breakfast and 35U at night, due to viewing his glucose levels via the LibreLink app. As he had suspected, the amount of insulin he had been using had been dropping him more than he had known during the night. His first LibreView report AGP (figure 1) showed that he spent 89% TIR – above the recommended target[1], 9% time in high, and 2% in low range, with an average glucose of 6.9 mmol and GMI of 6.3%.

Figure 1: Harry's first AGP Report.



AGP Report

11 August 2022 - 24 August 2022 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

11 August 2022 - 24 August 2022	14 Days
% Time Sensor is Active	96%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 3.9-10.0 mmol/L	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)

Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Average Glucose	**6.9** mmol/L
Glucose Management Indicator (GMI)	**6.3% or 45 mmol/mol**
Glucose Variability Defined as percent coefficient of variation (%CV)	**30.2%**

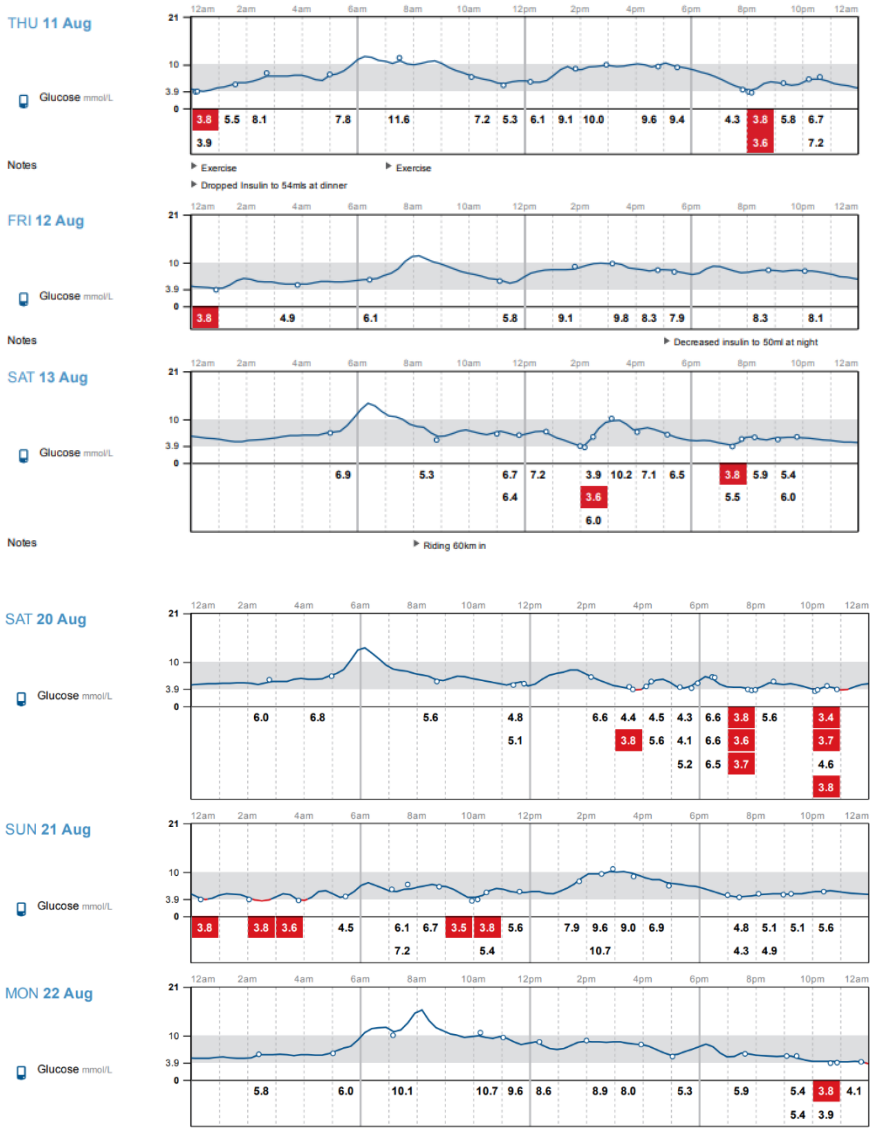
TIME IN RANGES

13.9
10.0
3.9
3.0

Very High	>13.9 mmol/L	0% (0min)
High	10.1 - 13.9 mmol/L	9% (2h 10min)
Target Range	3.9 - 10.0 mmol/L	89% (21h 21min)
Low	3.0 - 3.8 mmol/L	2% (29min)
Very Low	<3.0 mmol/L	0% (0min)

Together, we assessed his Daily Log on the LibreView report, and Harry was able to see the impact of general exercise and his long cycling sessions on his glucose levels. Figure 2 shows where Harry logged his exercise into his LibreLink app showing increases in his BG while riding up Perth's hills region and hypoglycaemic events occurring much later in the day. Harry could see that he was experiencing lows regularly occurring between 8pm–10pm and around midnight–2am and on a few occasions a few hours after longer rides. Harry noticed after a 100 km ride on a Saturday, his low alert alarm kept going off up to 8–24 hours later. We discussed the impact of endurance exercise and the need to either reduce his pre-ride insulin, and/or eat something higher in carbohydrate before and/or on return from a ride. He was also able to assess the impact of different foods on raising his glucose level, which he said was helping him to find more motivation to stick to his lower carb meals and snacks.

Figure 2: Examples of Daily Log with impact of exercise and hypoglycaemia.



Harry was still very stressed by his risk factors and taking all this medication longer term. I wrote to Harry's GP regarding his diabetes medication regimen and to update him on Harry wanting to continue with lower carb eating. I advised that I had suggested Harry continue to trial Humalog 35U nocte, and using his Libre 2, monitor if BGs stabilised over the next few nights. I encouraged Harry to discuss with his GP about a review of his oral and injectable diabetes management medications, given how low carb Harry's eating had become and his TIR percentage shown on the LibreView being in the high 90s.

When I saw Harry again at the end of 2022, he said that his GP supported reducing his insulin as much as Harry felt necessary — which Harry had done — further reducing his insulin to 20U AM and 10U PM. Harry's GP had recently changed his Janumet to Xigduo 10/1000 mg OD. Harry advised that since this time, his Libre 2 was alerting him that he was having hypos again overnight, as well as some instances during the day. I wrote to Harry's GP suggesting that with a low carbohydrate eating approach, it's common for patients to have their oral and injectable diabetes medications reduced or ceased as glucose levels improve. I also wrote that it's generally recommended to use caution with sodium-glucose co-transporter 2 inhibitor (SGLT2-i) medications due to the increased risk of euglycaemic diabetic ketoacidosis[2]. However, the GP did not further adjust Harry's medication, but Harry had already decided before seeing me to continue monitoring his Libre 2 and continue reducing his insulin on his own.

From the first use of the Libre 2, Harry was so impressed with the data he was getting that he has been privately purchasing more sensors and wearing them ever since. I have seen him eight times since his initial visit, and I last saw Harry in person in mid-2023. At that time, his HbA1c was 6.8% (compared with 8.0% in May 2022). He had ceased his insulin five months prior (previously using 120U per day a year earlier) and had lost just over 30 kg (now 94 kg). He had finally started using Ozempic and his oral diabetes medications had not been changed. He was no longer experiencing any hypos.

His LibreView report at that last appointment showed TIR of 99% (compared to 89%), time in high as 1% (previously 9%) and time in low as 0% (previously 2%). His average glucose was 7.1 mmol. See figure 3 for his 14-day snapshot.

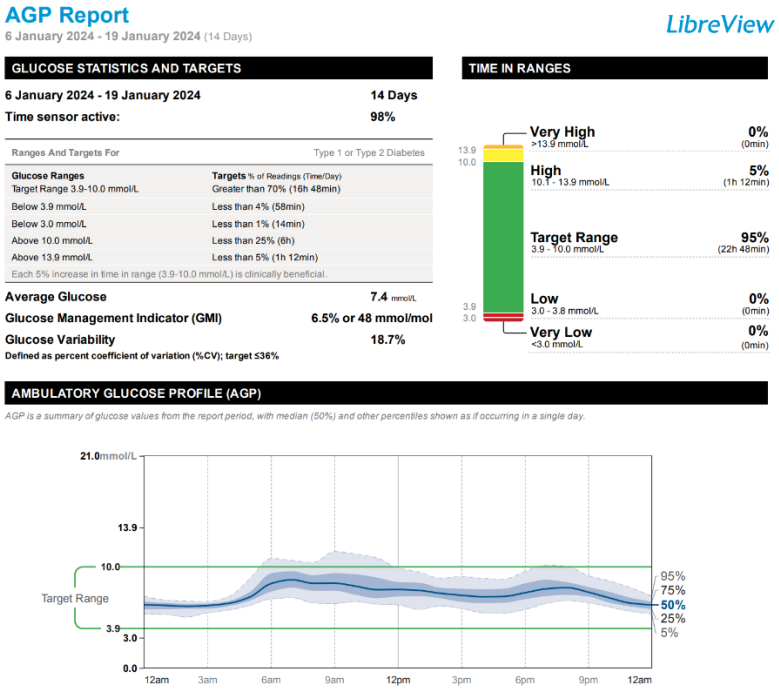
Figure 3: 14-day snapshot.

Conclusion

Even though Harry's glucose data would be enviable to many people living with type 2 diabetes, these small changes were significant for him. Further, the ability to get the feedback instantly has given Harry great motivation to continue eating well. Thanks to using the Libre 2, he was much less anxious about having lows while riding or during his sleep — knowing that the alarm would notify him.

The great thing about accessing LibreView is that even though I've not seen Harry since mid-2023, I can log in and see where he's at any time. It provides me with data that I can access from anywhere, and I can offer a patient a review or some additional support. Figure 4 shows that Harry has privately purchased 37 sensors, and he last wore a sensor in early 2024. According to his report, he seems to be maintaining his glucose targets, consistent with when I last saw him in mid-2023.

Figure 4: Latest AGP Report.



The inconsistent wearing of his Libre 2 might suggest that Harry's feeling much more confident with his diabetes management and now that he's not taking insulin, he doesn't need to worry so much about hypos. He's possibly also having issues being able to buy it off-label now that he no longer uses insulin. He confirmed he was doing well when consenting to this case study, and the ongoing cost was no longer justified.

For any person living with type 2 diabetes using insulin, accessing the Libre 2, which provides such useful and lifesaving real-time feedback, is off-limits to many who cannot afford it. The impact it also has on maintaining lifestyle changes cannot be underestimated. All people with any type of diabetes should be able to afford to access such devices to help their day-to-day self-management and reduce both short- and long-term complications of their condition.

References

1. Saboo B, Kesavadev J, Shankar A, Krishna MB, Sheth S, Patel V, et al. Time-in-range as a target in type 2 diabetes: an urgent need. Heliyon. 2021 Jan;7(1). doi:10.1016/j.heliyon.2021.e05967

2. Stranks SN, Lawlor-Smith L. Managing T2D with therapeutic carbohydrate reduction [Internet]. Australian Diabetes Society; 2023 [cited 2024 Apr 14]. Available from: https://www.diabetessociety.com.au/wp-content/uploads/2023/11/Managing-Type-2-Diabetes-with-Therapeutic-Carbohydrate-reduction-TCR-November-2023_Final.pdf

Case five

Abi Oliver

Using continuous glucose monitoring to improve outcomes and quality of life of an older person living with type 1 diabetes

Introduction

I am an RN CDE working in community health in Melbourne. I work in a team of CDEs with nursing and dietetics backgrounds. We work as part of a multidisciplinary team that includes referrers, specialists, and tertiary diabetes services.

This case study describes the experience and benefits of using CGM to improve outcomes and the quality of life of an older person living with type 1 diabetes. Joan (pseudonym) is an 80-year-old woman living with type 1 diabetes for the past 40 years. Joan is divorced and lives alone in her own home. Her son lives in rural Victoria, and she has limited support. She had a My Aged Care assessment previously with home modifications and has cleaning fortnightly. Joan attends the diabetes service at a major metropolitan hospital clinic. Her GP referred her to her local diabetes educator in September 2023 following a hypoglycaemic episode at a medical appointment. Her HbA1c was 6.8%. Joan's history includes:

- Diabetes kidney disease
- Obesity
- Metabolic-associated Fatty Liver Disease (MAFLD)
- Sleep apnoea
- Osteoarthritis knees
- Breast cancer
- Uterine cancer
- Hypoparathyroidism
- Chronic low back pain

Assessment

At the time of her referral, Joan's diabetes was being treated with NovoRapid 32–40 units with meals, which she self-titrated according to her BGL and Optisulin 64 units daily. She is also prescribed Ozempic 1g, which she takes as available.

Joan takes her medications with the aid of a blister pack. She only occasionally forgets to take insulin. Joan sees her GP and endocrinologist regularly. She has regular podiatric care and completes the recommended diabetes screening.

When Joan was referred to diabetes education, she was using fingerstick BGL monitoring and checking her BGLs up to eight times/day. Joan had used the Libre 2 CGM device previously; however, she found it problematic due to the device dislodging and had exhausted her subsidised supply sensors. We contacted the NDSS and were successful in accessing additional sensors.

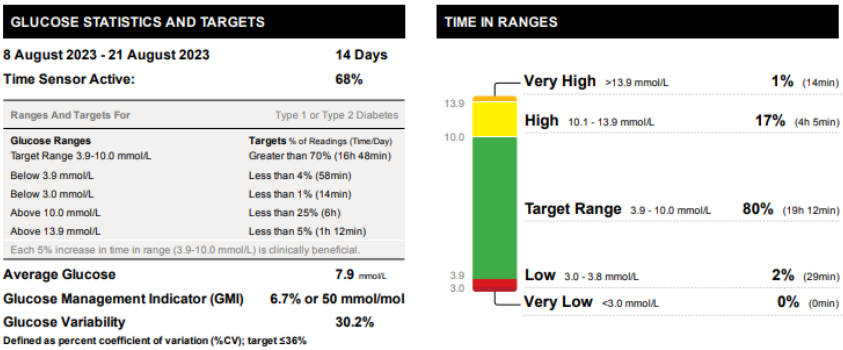
Joan was concerned that her high insulin dose was causing weight gain and that her BGLs were fluctuating, irrespective of how careful she was with her diet. Joan reported feeling that dealing with her erratic BGLs was stressful and affected her quality of life. She had sore fingers from finger pricking. During our initial consultation together, we reviewed BGLs and ketone monitoring and discussed changing the lancets more regularly to reduce discomfort. We also looked at possible reasons for erratic glucose levels and inconsistent response to insulin.

We reviewed Joan's insulin technique and discovered the following issues:

- Injection site: Joan had an abnormal site on her abdomen where she injected insulin. I was concerned that there might be lipohypertrophy present and suggested site rotation, avoiding this area, and GP assessment of the site.
- Joan was using 8 mm needles and was not using a new needle every injection, due to inconvenience and not being aware of the recommendation to do so. Joan swapped to 4–6 mm needles and we discussed the rationale for changing needles every injection.

Joan's BG record showed labile glucose with hypoglycaemia and hyperglycaemia. Her previous sensor reports (prior to referral to current diabetes education service) showed hypoglycaemia and suboptimal data available due to sensor failure (figure 1).

Figure 1



GLUCOSE STATISTICS AND TARGETS

8 August 2023 - 21 August 2023	**14 Days**
Time Sensor Active:	**68%**

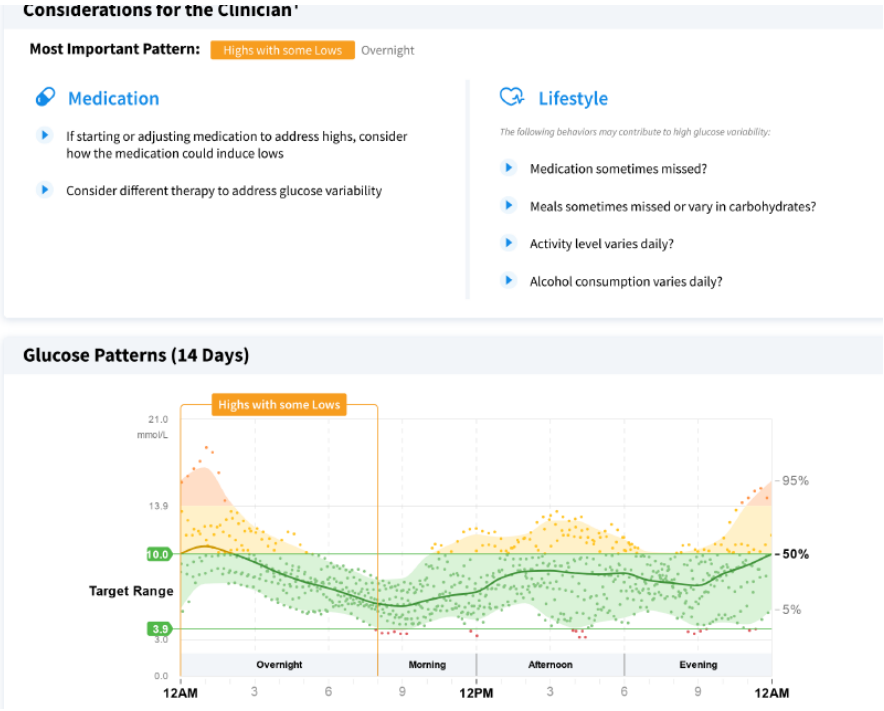
Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 3.9-10.0 mmol/L	Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)

Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Average Glucose	**7.9** mmol/L
Glucose Management Indicator (GMI)	**6.7% or 50 mmol/mol**
Glucose Variability	**30.2%**

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



We reviewed hypoglycaemia/hyperglycaemia management and discovered that Joan may have been over-adjusting for both low and high BGLs due to anxiety related to adverse outcomes.

My initial impression was that Joan was working hard to optimise her health and manage her diabetes but was experiencing difficulty doing so due to several factors.

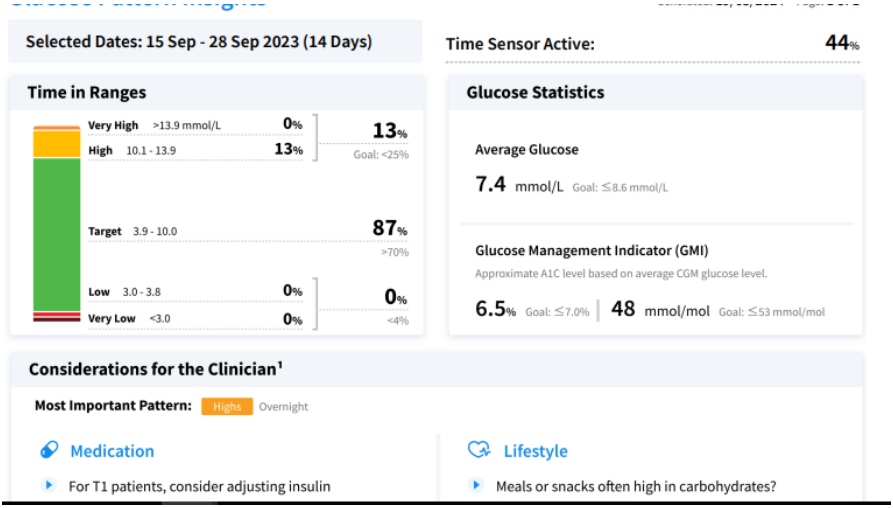
The immediate safety priority was preventing hypoglycaemia, particularly due to the possible reduction in Joan's insulin requirements by changing her insulin injection sites. We discussed the possibility of lower insulin requirements and strategies to avoid hypoglycaemia. To help this, Joan recommenced CGM with a Libre 2, linked to the diabetes education service, her relative, and endocrinologist. We decided on a low-glucose alarm of 5 mmol/L initially, with 'do not disturb' override and alarm sounds on. The rationale for this was to

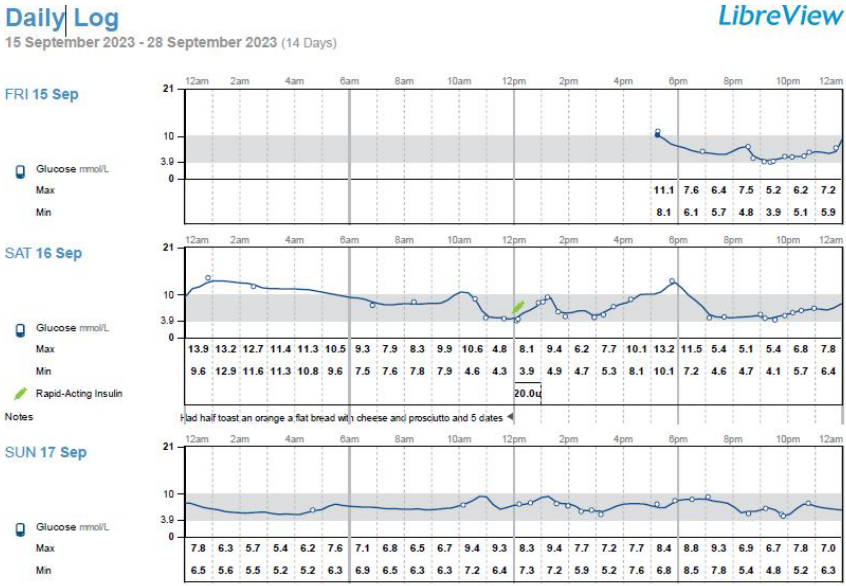
give Joan time to identify and treat a falling glucose level without having to over-treat with sugar and to ensure glucose was at a safe level for driving and hydrotherapy.

Management

Initially, Joan had ongoing difficulties with the sensor failing. This problem is reflected in the report below, which shows sensor active only 44%. However, Joan was able to reduce her insulin dose to 20 units (was 32–40 units) of NovoRapid with meals and 55 units (previously 64 units) of Optisulin daily with improvements as shown in figure 2.

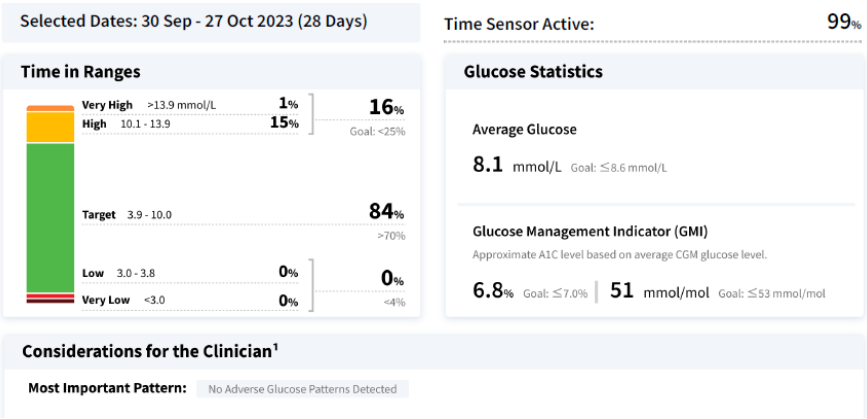
Figure 2





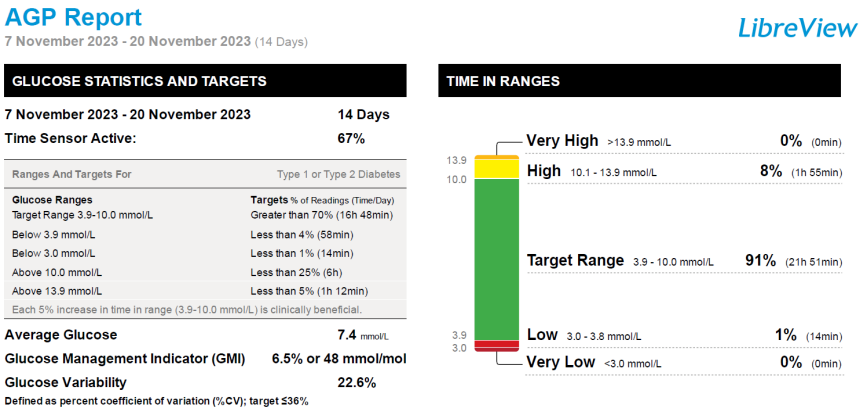
Within one month, Joan had reduced her insulin to 10–14 units (from 30–40 units) of NovoRapid at meals and 42 units (from 64 units) of Optisulin. Her glucose stability improved, with less hypoglycaemia, as shown in figure 3.

Figure 3



Joan's goal was to avoid hyperglycaemia to maintain kidney function and lose 10 kg. Joan reported 'topping up' with NovoRapid, sometimes resulting in low glucose requiring treatment. We discussed using a NovoPen 6 to assist with remembering insulin doses and timing and help assess insulin requirements and interpret glucose reports. Joan also saw the dietitian to discuss dietary strategies. A further improvement for Joan occurred with the update of the Libre 2 app. Joan also lost 4 kg and was pleased with the reduced insulin dose. Her glucose report showed improvement in TIR, up to 91% with less hypoglycaemia and glucose variability (figure 4).

Figure 4



AGP Report

7 November 2023 - 20 November 2023 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

7 November 2023 - 20 November 2023	14 Days
Time Sensor Active:	67%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 3.9-10.0 mmol/L	Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

Average Glucose	7.4 mmol/L
Glucose Management Indicator (GMI)	6.5% or 48 mmol/mol
Glucose Variability	22.6%

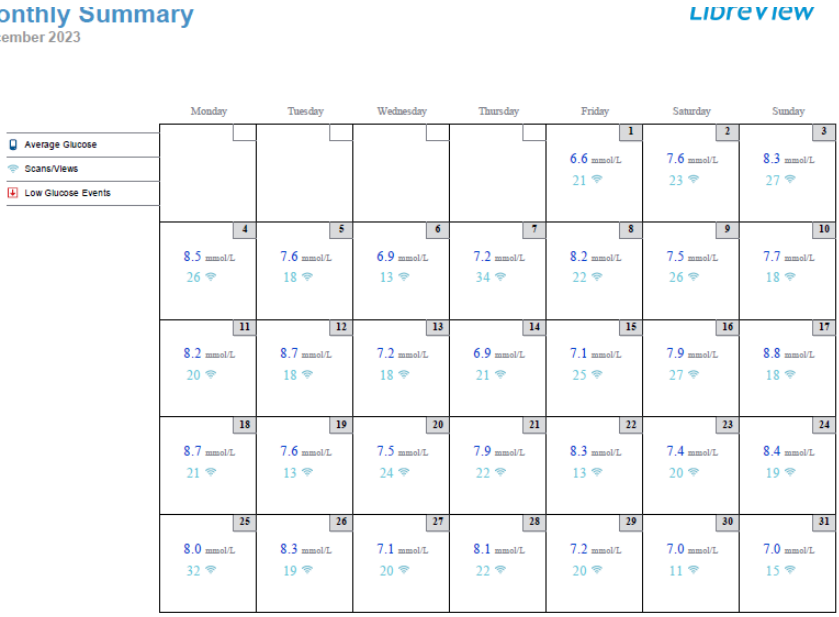
Defined as percent coefficient of variation (%CV); target ≤36%

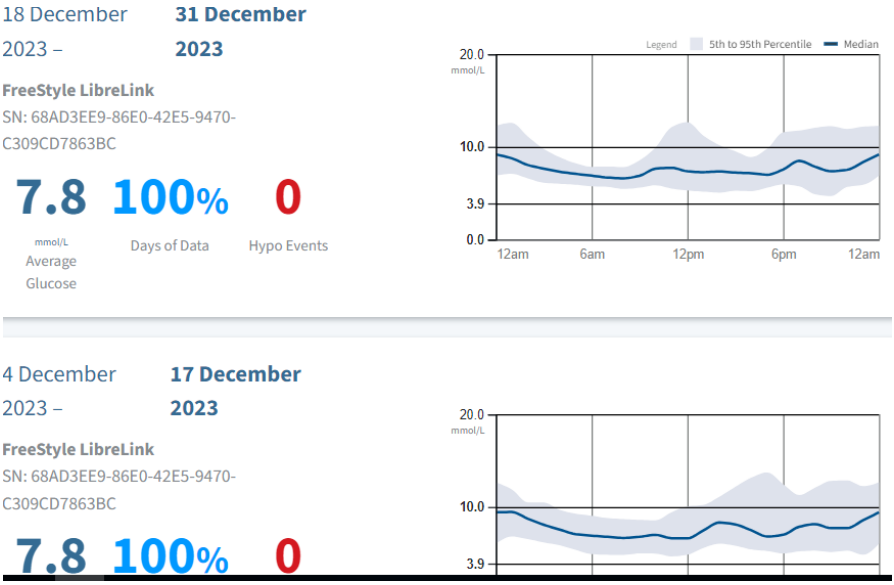
TIME IN RANGES

	Very High	>13.9 mmol/L	0% (0min)
13.9	High	10.1 - 13.9 mmol/L	8% (1h 55min)
10.0	Target Range	3.9 - 10.0 mmol/L	91% (21h 51min)
3.9	Low	3.0 - 3.8 mmol/L	1% (14min)
3.0	Very Low	<3.0 mmol/L	0% (0min)

Joan actively monitored her glucose, and her glycaemic state continued to improve (figure 5).

Figure 5


Monthly Summary
December 2023
LibreView
Average Glucose
Scans/Views
Low Glucose Events
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
1
6.6 mmol/L
21
2
7.6 mmol/L
23
3
8.3 mmol/L
27
4
8.5 mmol/L
26
5
7.6 mmol/L
18
6
6.9 mmol/L
13
7
7.2 mmol/L
34
8
8.2 mmol/L
22
9
7.5 mmol/L
26
10
7.7 mmol/L
18
11
8.2 mmol/L
20
12
8.7 mmol/L
18
13
7.2 mmol/L
18
14
6.9 mmol/L
21
15
7.1 mmol/L
25
16
7.9 mmol/L
27
17
8.8 mmol/L
18
18
8.7 mmol/L
21
19
7.6 mmol/L
13
20
7.5 mmol/L
24
21
7.9 mmol/L
22
22
8.3 mmol/L
13
23
7.4 mmol/L
20
24
8.4 mmol/L
19
25
8.0 mmol/L
32
26
8.3 mmol/L
19
27
7.1 mmol/L
20
28
8.1 mmol/L
22
29
7.2 mmol/L
20
30
7.0 mmol/L
11
31
7.0 mmol/L
15



In addition to participating in diabetes education, Joan engaged with community health nursing, who helped Joan enhance her safety and quality of life by arranging a personal alarm and incontinence assistance.

Joan was reviewed fortnightly until she was confident to apply her Libre 2 sensor independently. The issue of the sensor becoming loose and failing was overcome by establishing a taping procedure to secure the sensor that Joan could manage herself.

The issue of postprandial hyperglycaemia was addressed by trying dietary changes and adjusting NovoRapid. Joan was encouraged to record her food intake and insulin doses; however, this is difficult to establish, and we are continuing to work on strategies to help Joan. Joan may use a NovoPen 6 to help correlate insulin doses with glucose levels, analyse glucose reports, and optimise insulin dosing and timing. At this stage, she is using up her supply of FlexPens.

Joan's diabetes management was disrupted by foot surgery, requiring an extended hospital stay and a period of immobility at the start of 2024. She has

since resumed physiotherapy and diabetes education. We are continuing to work together to achieve Joan's goals and optimise her diabetes self-management. Joan liaises closely with her endocrinologist and GP and there is communication among her health professionals.

Conclusion

Joan's case shows the importance of thorough assessment and covering the basics of diabetes education — including insulin administration, monitoring, lifestyle factors, prevention, and management of hypoglycaemia/hyperglycaemia — even for a person experienced in diabetes self-management. It also highlights the ongoing burden of diabetes and the resilience and commitment required by the person living with diabetes.

Joan's quality of life and safety were improved by using the Libre 2 system. The use led to safer insulin dose adjustments, the setting of precise alarms to prevent hypoglycaemia, and a reduced monitoring burden. It also helped her maintain her independence and ensured safe driving.

Joan is able to assess the effects of food, exercise, and insulin on her glucose level. She reports that the Libre 2 provides peace of mind for her and her family via LibreLink, shared with her relative with type 1 diabetes, her endocrinologist, and her diabetes educator.

<u>These are Joan's reflections about diabetes education and using the Libre 2 CGM:</u>

'One of the best things you did for me is finding out that I was injecting at the same spot. By changing it, it improved the way the insulin acted. When I go to the pool, I use my phone to check my sugar as the exercise in the water can change things very quickly. This is where the app LibreLink is great. Just a couple of big points for your case study. If you want me to look at it once you've done it, I will be happy to. Good luck with it.'

What I like about LibreLink:

- *No finger pricking.*

- *Available reading 24/7.*
- *Alarm when high or low glucose.*
- *Able to share data with health professionals: enables more accurate treatment.*
- *Sharing data with family: enabled my grandchild to see when I was experiencing low blood sugar.*
- *Ability to use as a diary.*
- *Replacement of sensor when it stops working.*
- *Free sensors.*

What I don't like:

- *When the sensor stops working.*
- *When the sensors fall off.*
- *To be woken up at night due low or high reading.*
- *Allergy caused by sensor (itchiness).*
- *Having to wait an hour for the sensor to be ready for use.*

Case six

Early career

Prue Reyne

Using the Libre 2 sensor on a patient undertaking a very low-calorie diet (VLCD) pre-bariatric surgery

The use of flash glucose meters, particularly the Libre 2 system, is becoming a more common practice in the management of both type 1 and type 2 diabetes management for people using insulin.

As a CDE, this system provides significant information that helps make clinical decisions while also empowering clients to play a more active role in their own management.

Client information:

- Name: Jane (pseudonym)
- Age: 55 years old
- Gender: Female
- Occupation: Unemployed
- Weight: 178 kg
- BMI: >40

Medical history:

- Type 2 diabetes requiring insulin
- Bilateral nephrolithiasis requiring stents and multiple urological procedures; recurrent urinary tract infections
- Hypertension
- Morbid obesity
- Depression
- Diverticular disease
- Previous cholecystectomy

- Previous hysterectomy
- Previous appendicectomy

Medications:

- Toujeo 160 units mane
- Humalog 40 units TDS with meals
- Jane reported that she self-titrated Toujeo up to a maximum of 200 units depending on BGLs).
- Jane reported that she was also given Humalog 20–40 units in between meals when BGLs were elevated.

Goal of treatment

Jane wanted to reduce the risk of hypoglycaemia while transitioning to a VLCD; support with insulin reduction and titration dependent on BGLs.

Presenting situation

Jane was booked in for elective bariatric surgery. She presented requesting assistance from the CDE with maintaining her BGLs while making the transition to a VLCD to lose about 18 kg in the four weeks before surgery.

Under the direction of a dietitian, Jane had begun transitioning to a VLCD (Optifast) by having one shake at lunchtime. Her insulin dosing was monitored by her GP initially and she was referred to the CDE to continue insulin titration in conjunction with the GP as per the Role and Scope of Practice for CDEs[1].

Jane had already decreased her Humalog dose to 30 units with lunch, with all other meals remaining at 40 units prior to the Libre sensor being applied. After two days, Jane had added in an Optifast shake for breakfast. She subsequently reduced her Toujeo down to 140 units and Humalog reduced at this meal also to 30 units.

BGLs were taken pre and postprandial and if symptomatic of hypoglycaemia, which is a key reason Jane was offered the Libre 2 sensor, she was not

engaged in BGL testing due to the constant requirements of this with experiencing increased pain due to repetitive finger pricking.

Jane was also under the care of a physiotherapist and social worker as part of her treatment at the health service.

Management

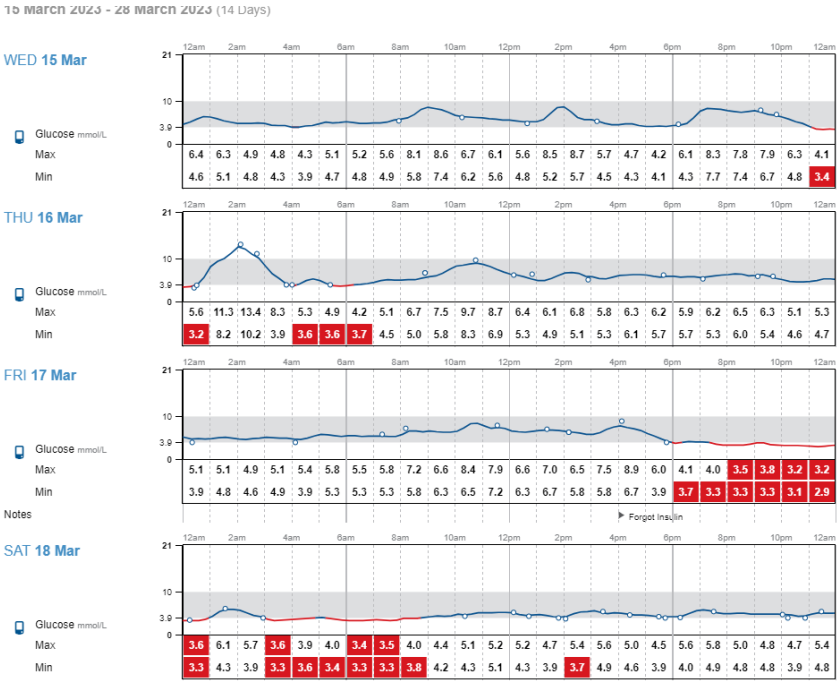
Jane was offered a free trial of the FreeStyle Libre 2 system (Libre) to receive instant feedback about how her food, activity and insulin doses were impacting her glucose levels. The real risk of hypoglycaemia when transitioning to a much lower carbohydrate diet made the Libre beneficial, with the ability to set glucose alarms that Jane could respond to without having to finger prick constantly, reducing pain and distress. Jane preferred to be discreet and was not comfortable with others knowing that she had diabetes —as a result, she would not have attended finger pricking in public as required. Being able to view her glucose levels on her mobile phone made the Libre system highly desirable for Jane.

Jane was educated on the use of the Libre — the sensor was inserted by the CDE in clinic and the phone application installed on her mobile phone. She was educated on how to scan the device, set alarms, and interpret the information shown on the screen, especially the glucose level and trend arrows. Jane set her glucose alarm at 4.5 mmol/L with sound and vibration alerts. She reported being symptomatic below 6 mmol/L generally; however, she tended to 'ignore' her symptoms rather than treating them. Hypoglycaemia management was re-iterated to Jane; despite her desire to avoid higher carbohydrate foods, she was encouraged to treat any hypoglycaemia events using the two-step approach[2].

With the final transition to Optifast VLCD for three meals per day plus protein/vegetable-based snacks in between as per dietitian recommendations, the Libre enabled both the care team and Jane to closely monitor glucose levels and discuss titration. Jane used the Libre sensor only for a two-week trial due to financial restraints and the fact that the sensors are not subsidised for type 2 diabetes at present.

The CDE and GP used information obtained via LibreView to assess and implement changes to Jane's insulin regimen during a 2–3-week period. Unfortunately, Jane's initial device was dislodged after only a few days. The customer service line at Abbott were contacted and a new sensor was sent out to Jane, which was re-inserted by the CDE and secured with medical-grade tape as suggested by Abbot customer service.

Figure 1: Glucose levels prior to review by CDE/GP.



It was noted that Jane was experiencing prolonged overnight hypoglycaemia — this was managed by a further reduction in Toujeo to 120 units and 15 units Humalog or omitting this altogether if glucose levels were below 6 mmol/L. Hypoglycaemia management was further reiterated at this time.

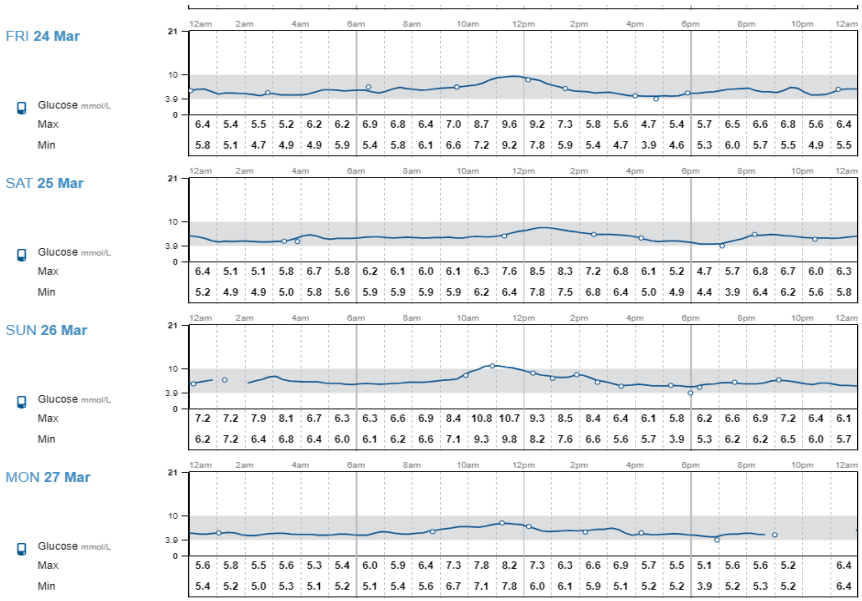
Jane's GP was notified and involved in ongoing insulin titration, using the principles recommended by the CDE for insulin titration[3].

Long-acting analogues are reduced by 30%, pre-mix or rapid insulin reduced by 50%.

If hypoglycaemia occurs, further insulin reduction to the dose preceding the hypoglycaemic episode to be reduced by 50%, with glucose levels ideally between 6–10 mmol/L.

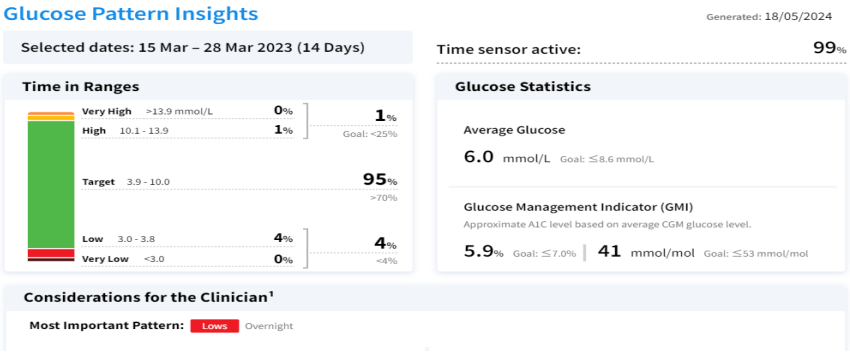
Jane's insulin doses were adjusted every 2–3 days, eventually stabilising with Toujeo 35 units mane and Humalog between 0 and 10 units depending on glucose levels.

Figure 2: Glucose levels after review of Libre data and insulin titration.



The reports obtained from LibreView enabled the GP and CDE to make decisions about Jane's clinical care, particularly her insulin doses. Daily patterns were also reviewed by the dietitian to adjust dietary management strategies as required. The issue of nocturnal hypoglycaemia was identified, and adjustments made to assist with maintaining a very good TIR. It is clear in the daily graph report where medication and dietary changes were made due to the decreased amount of hypoglycaemia and increased overall TIR. In addition to this, the treating team was able to look deeper into the hypoglycaemic episodes to determine frequency, duration, and the circumstances around the hypoglycaemic episode.

Figure 3: AGP Report.



Jane experienced improved clinical outcomes using the Libre sensor.

- Better glycaemic control and decreased hypoglycaemia — the ability to effectively use trend arrows and CGM to prevent further hypoglycaemia while transitioning to a VLCD allowed Jane to titrate insulin dependent on glucose levels and increase safety (e.g. ensure driving safely above 5 mmol/L).
- Through using continuous data provided to the healthcare professional, the Libre allowed for timely medication and dietary interventions to improve overall glycaemic control.

Jane also experienced a reduction in the burden of managing her diabetes as she did not need to perform multiple fingerpick tests, thus reducing the physical and emotional stress of diabetes management. The real-time data provided by the LibreLink application on her mobile phone allowed better insight to make decisions about diet and insulin dosing, as well as increased engagement, while reducing clinical risk of hypoglycaemia – her goal of treatment.

For the diabetes care team, the technology behind the Libre allowed all members to effectively make clinical decisions using real-time data despite them not all being based in the same location. This is a common problem in rural areas (where Jane is based) — having access to LibreLink enables continuity of care and monitoring for all members. This technology can be life-changing for the patients who use it, and it results in improved clinical care and outcomes for the health professionals using it as part of their treatments.

There were two main challenges voiced by Jane in her experience with the Libre system.

- Sensor adhesion: on the advice of Abbott customer service, the replacement sensor was able to be further secured using medical grade tape, which was successful in solving this issue.
- The significant cost of the Libre system was also limiting to Jane, who was unable to afford the sensor ongoing, and it is not currently subsidised to her as a person living with type 2 diabetes.

Conclusion

Despite the challenges, Jane was able to successfully and safely adhere to a two-week period of VLCD before undergoing bariatric surgery. In this two-week period, Jane lost 11 kg and was able to safely maintain an average glucose level of 6.0 mmol/L. The benefits of the Libre device were imperative to Jane's success. Without the option of the two-week free trial, the CDE/GP would have struggled to help Jane in a timely manner to prevent and manage her hypoglycaemia, leading to poor outcomes overall. Jane herself found the Libre an excellent tool, impacting positively on her quality of life.

References

1. Australian Diabetes Educators Association. Role and Scope of Practice of Credentialled Diabetes Educators in Australia (Internet). Australian Diabetes Educators Association; 2022. Available from: https://www.adea.com.au/wp-content/uploads/2022/08/Role-and-Scope-of-Practice-of-Credentialled-Diabetes-Educators-in-Australia-2022.pdf

2. National Diabetes Services Scheme. Managing hypoglycaemia [Internet]. National Diabetes Services Scheme; 2022. Available from: https://www.ndss.com.au/wp-content/uploads/fact-sheets/fact-sheet-managing-hypoglycaemia.pdf

3. Thorell A, Hagström-Toft E. Treatment of diabetes prior to and after bariatric surgery. J Diabetes Sci Technol. 2012;6(5):1226-32. doi:10.1177/193229681200600528

Case seven

Sabrina Sharp

Supporting our patient by enhanced technology to achieve safe glucose levels and autonomy in palliative self-care during chemotherapy

Introduction

Underpinning clinical services provided by the Royal Prince Alfred Hospital Diabetes Centre is integrated multidisciplinary care by CDEs, endocrinologists, dietitians, podiatrists and administration staff. Increasingly, oncologists from the Chris O'Brien Lifehouse have requested our help, especially for those who are receiving chemotherapy including steroids. This case outlines the benefits of the FreeStyle Libre in this setting.

Rex, a 65-year-old gentleman, was diagnosed with type 2 diabetes in 2020. He was treated with Xigduo XR. In January 2024, he was diagnosed with metastatic pancreatic cancer and started chemotherapy with Dexamethasone on days 1–3 of a 14-day cycle, ongoing.

It soon became apparent that the Dexamethasone was causing significant hyperglycaemia, and the Diabetes Centre staff were consulted regarding the need for insulin therapy. Based on our clinical experience and published literature about potential utility of CGM in steroid-exacerbated diabetes, a trial of FreeStyle Libre was introduced to aid safe decision making and care.

Initially, Rex experienced increasing glucose levels into the 20+ mmol/L range and quickly needed to learn to manage a basal-bolus insulin regimen. The Dexamethasone dosing added the challenge of markedly variable glucose levels.

Rex was able to manage his diabetes confidently and safely with the help of the FreeStyle Libre system and the support of his diabetes team. He reported the positive effect it had on his life in saying:

'I can see what is happening in real time and feel safe to go to sleep at night, knowing the trends and alarms are available for me and my wife to see on my mobile phone, anytime.'

Rex was able to continue working in the family business and, importantly, remain at home enjoying his usual lifestyle. He reported:

'Once I understood the impacts of treatment on my sugars, I knew I could make decisions myself, about going to work and even choosing what I wanted to eat and when!'

Rex told us that his cancer had a name: 'Sid. It's short for insidious.' From the outset, Rex was fully engaged in his management. His positive approach and larrikin streak would see him through challenges of multiple cycles of chemotherapy, feeling unwell, numerous specialist appointments, blood tests and medical imaging, and the highs and lows associated with a cancer diagnosis.

Assessment

Despite receiving the devastating incurable cancer diagnosis, Rex was very keen to start chemotherapy treatment immediately to help prevent cancer progression and maintain his quality of life. Understandably, he was overwhelmed, and we informed him that he also needed to start insulin therapy.

We discussed with Rex the practical implications of chemotherapy and Dexamethasone on his glucose management. Ongoing hyperglycaemia often causes people undergoing chemotherapy to experience suboptimal outcomes. The elevated glucose levels contribute to dehydration, lethargy, and malabsorption. Combined with Dexamethasone, it can adversely affect cognition with a loss in clear thinking and altered mood. In our experience, many people are not aware that these symptoms are not solely related to side effects of chemotherapy. Thus, hyperglycaemia may go undertreated.

We also know from experience that many people restrict their food intake to avoid higher glucose readings, ultimately leading to further weight loss, muscle weakness with muscle sarcopenia, malnutrition, lethargy, and reduced quality of life. Rex was very engaged and was encouraged to examine the different impacts food, exercise, treatment, and stress had on his glucose levels.

We were excited to offer him the opportunity to trial the FreeStyle Libre system.

In Rex's own words, he described himself as not particularly tech-savvy and was even a little reluctant to trial any new technology. Patient-centred education gave Rex the ability to choose whether to trial the FreeStyle Libre system. Moreover, we were able to directly involve him in the decision-making process related to his care.

Management

The decision was made, from a safety perspective, to cease the Xigduo to reduce the risk of diabetic ketoacidosis in the context of the sodium-glucose co-transporter 2 (SGLT2) inhibitor and the potential for poor appetite during chemotherapy. He was commenced on basal insulin therapy and from day one, we were able to work with Rex to calculate his insulin doses.

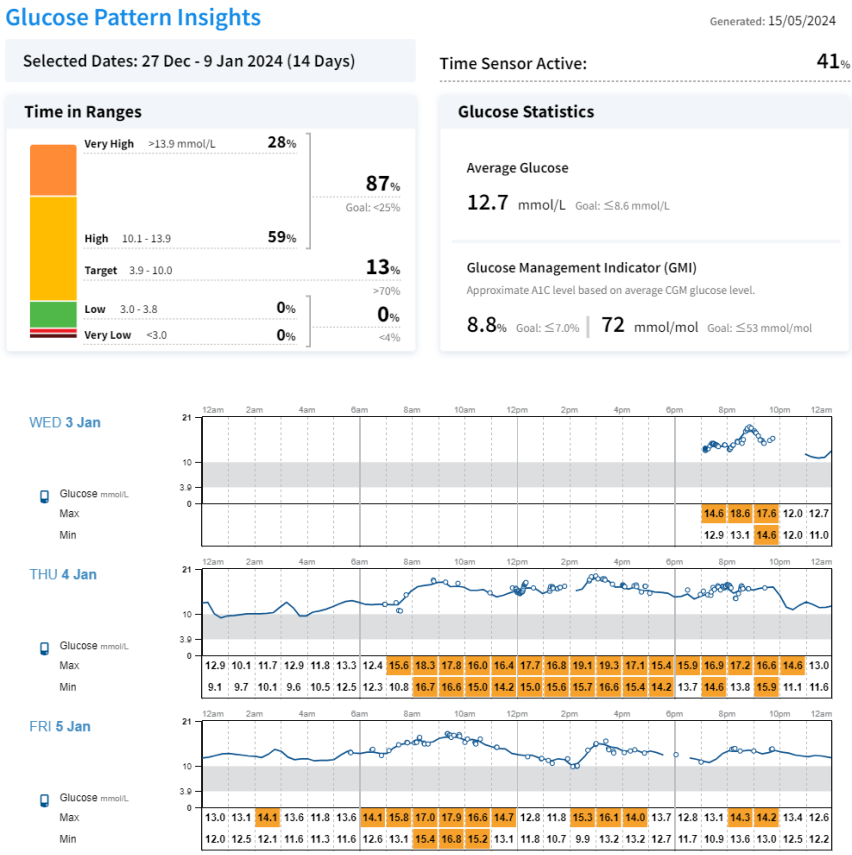
His chemotherapy cycle was every two weeks with Dexamethasone 8 mg on day one, 4 mg on days two and three.

Rex was taught to use the FreeStyle Libre 2 sensor and LibreLink app and he was linked to the RPA LibreLink account to facilitate remote monitoring.

Given the complexity of his medical condition, our goals for Rex were conservative. With his involvement in the decision-making process, a target glucose level between 5.0–15.0 mmol/L range was agreed. It was important that we avoided any episodes of symptomatic hypoglycaemia.

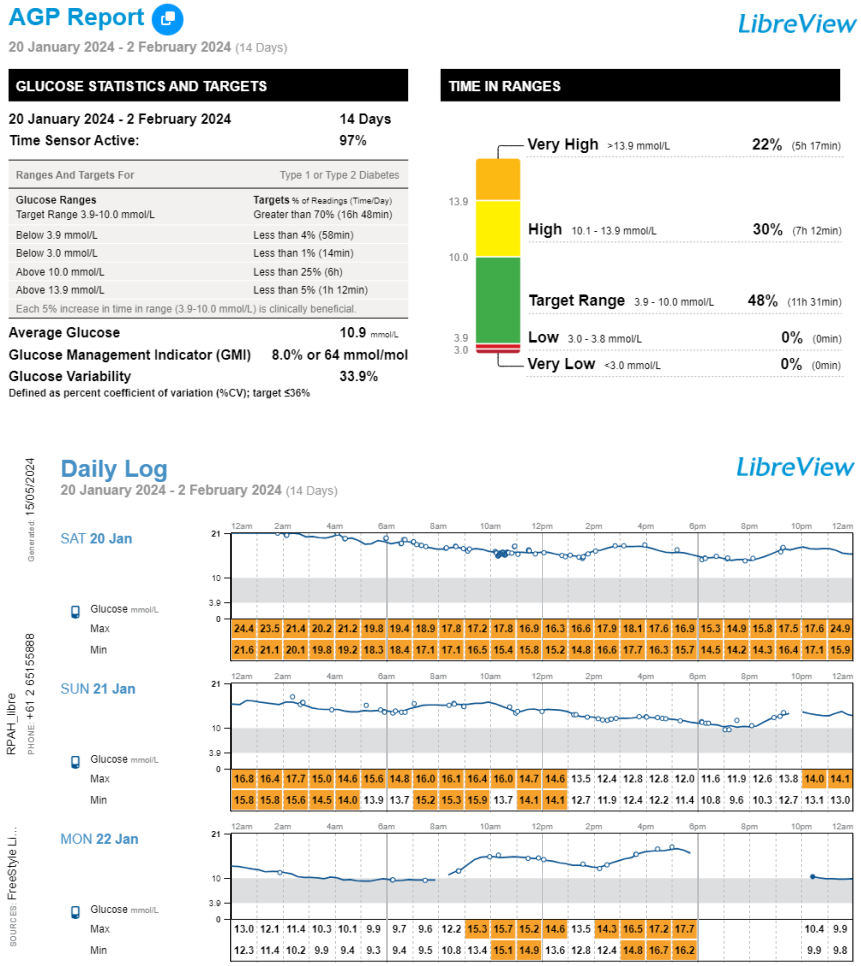
We initially prescribed Optisulin (U100) 15 units on the days with Dexamethasone.

Figure 1: Initial insulin dosing and glucose levels recorded across the end of year festive season period.



It soon became clear that on the days of Dexamethasone treatment, his glucose levels increased markedly and stayed elevated for several days. Having access to detailed data from the Libre device, we felt confident in increasing the Optisulin U100 to 22 units on the Dexamethasone days.

Figure 2: It was clear after second round of chemotherapy that he required substantially more insulin. Rex was agreeable to a significant increase in his basal insulin and to commence prandial insulin.



AGP Report

20 January 2024 - 2 February 2024 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

20 January 2024 - 2 February 2024	14 Days
Time Sensor Active:	97%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 3.9-10.0 mmol/L	Targets % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

Average Glucose	10.9 mmol/L
Glucose Management Indicator (GMI)	8.0% or 64 mmol/mol
Glucose Variability	33.9%

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES

Very High	>13.9 mmol/L	22%	(5h 17min)
High	10.1 - 13.9 mmol/L	30%	(7h 12min)
Target Range	3.9 - 10.0 mmol/L	48%	(11h 31min)
Low	3.0 - 3.8 mmol/L	0%	(0min)
Very Low	<3.0 mmol/L	0%	(0min)

13.9 · 10.0 · 3.9 · 3.0

Daily Log

20 January 2024 - 2 February 2024 (14 Days)

LibreView

Generated 15/05/2024

RPAH_libre PHONE +61 2 65155888

SOURCES FreeStyle Li...

SAT 20 Jan

Glucose mmol/L

Max 24.4 23.5 21.4 20.2 21.2 19.8 19.4 18.9 17.8 17.2 17.8 16.9 16.3 16.6 17.9 18.1 17.6 16.9 15.3 14.9 15.8 17.5 17.6 24.9

Min 21.6 21.1 20.1 19.8 19.2 18.3 18.4 17.1 17.1 16.5 15.4 15.8 15.2 14.8 16.6 17.7 16.3 15.7 14.5 14.2 14.3 16.4 17.1 15.9

SUN 21 Jan

Glucose mmol/L

Max 16.8 16.4 17.7 15.0 14.6 15.6 14.8 16.0 16.1 16.4 16.0 14.7 14.6 13.5 12.4 12.8 12.8 12.0 11.6 11.9 12.6 13.8 14.0 14.1

Min 15.8 15.8 15.6 14.5 14.0 13.9 13.7 15.2 15.3 15.9 13.7 14.1 14.1 12.7 11.9 12.4 12.2 11.4 10.8 9.6 10.3 12.7 13.1 13.0

MON 22 Jan

Glucose mmol/L

Max 13.0 12.1 11.4 10.3 10.1 9.9 9.7 9.6 12.2 15.3 15.7 15.2 14.6 13.5 14.3 16.5 17.2 17.7 10.4 9.9

Min 12.3 11.4 10.2 9.9 9.4 9.3 9.4 9.5 10.8 13.4 15.1 14.9 13.6 12.8 12.4 14.8 16.7 16.2 9.9 9.8

NovoRapid: six units with main meals.

Optisulin increased to:

- 40 units mane – day one (Dexamethasone 8 mg mane)
- 30 units mane – day two and three (Dexamethasone 4 mg mane)

- 22 units mane – day four (ongoing)

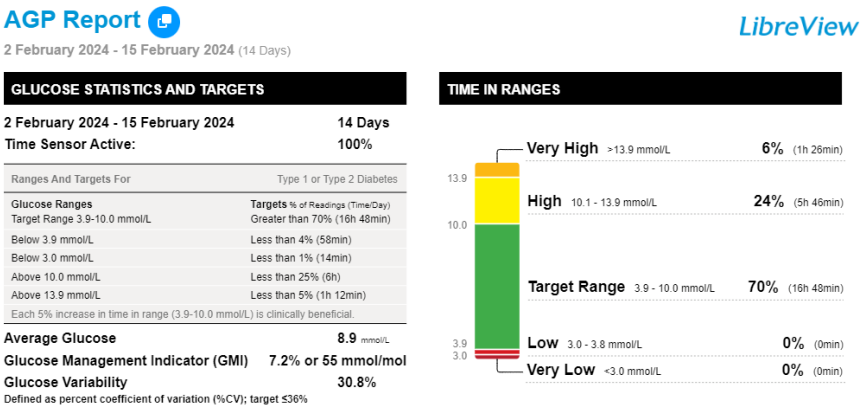
FreeStyle Libre allowed us to review the effect of treatment decisions, assess the data and plan the next step with Rex's preferences in mind. Rex stated that remaining independent was his absolute priority.

His insulin requirements escalated rapidly. We were slightly anxious about doubling and even tripling the doses of insulin. Without access to constant glucose data from the Libre, we would have been reluctant to make such significant dosage changes, from a starting dose of Optisulin U100 15 units daily to 50 units on day one. Enabling Rex to maintain his independence was our priority and at this point, we introduced Rex to the idea of 'correcting' high glucose levels at mealtimes using NovoRapid insulin. The real-time data provided Rex with the information to calculate his doses safely and confidently, without his glucose becoming a burden. His TIR increased to 70%.

NovoRapid: six units with main meals with high dose correction card.

Optisulin increased to:

- 50 units mane – day one
- 38 units mane – day two and three
- 30 units mane - day four
- 22 units mane – day five (ongoing)



AGP Report

2 February 2024 - 15 February 2024 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

2 February 2024 - 15 February 2024	14 Days
Time Sensor Active:	100%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 3.9-10.0 mmol/L	Targets % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)

Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Average Glucose	8.9 mmol/L
Glucose Management Indicator (GMI)	7.2% or 55 mmol/mol
Glucose Variability	30.8%

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES

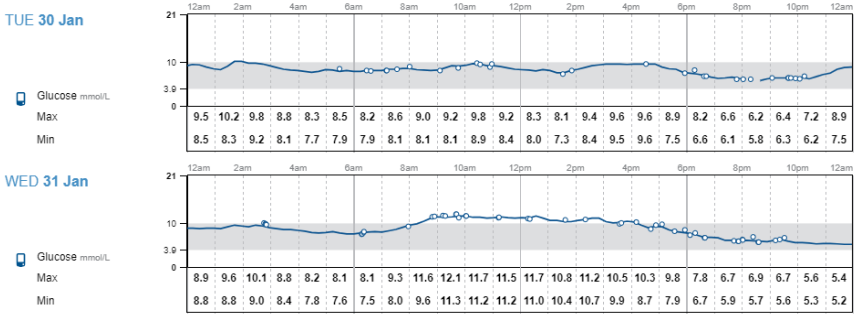
13.9
10.0
3.9
3.0

Very High	>13.9 mmol/L	6% (1h 26min)
High	10.1 - 13.9 mmol/L	24% (5h 46min)
Target Range	3.9 - 10.0 mmol/L	70% (16h 48min)
Low	3.0 - 3.8 mmol/L	0% (0min)
Very Low	<3.0 mmol/L	0% (0min)

'Some days, it could be exhausting travelling to the chemo suite, having the

chemo, waiting around for blood results, and seeing so many doctors and nurses. But the team at the Diabetes Centre were always available to speak with me, either over the phone, via email, and would even come and see me at the chemo centre. They were always one step ahead of everyone else. I never needed to worry about my blood sugars. Even on the days they were high, I knew we had a plan!'

Figure 3: Rex's glucose levels when not on Dexamethasone.



Being able to access Rex's real-time data through the LibreLink account meant all members of his team had access to reports if he reached out for support. This integrated model allowed Rex to maintain confidence even if things did take a detour, and if he did become unwell, his self-management strategies were robust enough to see him manage at home. Importantly, he was able to avoid several potential hospitalisations. As indicated below in his comment, Rex was very confident with the support he was receiving.

Conclusion

Rex tells us he feels like he can overcome anything now.

'*The Libre Flash system has really given me back a sense of being able to manage myself. I feel confident when I talk to the chemo nurses about controlling my blood sugars. In the beginning, the nurses would make me walk around the chemo suite until my blood sugars started coming down before they would let me go home. I felt like I wasn't in control of anything. Not my chemo, my sugars, my life.*'

As Rex's chemo cycles continued, we needed to have much less input. We review him remotely and send him an email intermittently to let him know we were thinking of him.

'Sid Senior and Sid Junior can keep trying, but I'm here and ready to keep fighting!'

'The best bloody thing is I can look forward to my favourite, a fettucine carbonara, to celebrate the end of each cycle of chemo. And I know exactly what to do with my insulin!'

We plan to continue to work closely with the oncology team at Chris O'Brien Lifehouse and are excited to use the NovoPen 6 with the FreeStyle Libre system moving forward. Working with patients like Rex reminds us that there is more to diabetes management than just 'fixing the blood sugars'. We have an opportunity to impact their physical, mental, emotional, and spiritual health with the person firmly at the centre of their care.

Reference

1. Yamada E, Sekiguchi S, Nakajima Y, Uehara R, Okada S, Yamada M. Pitfalls of intermittent continuous glucose monitoring in patients with steroid diabetes. Endocr J. 2021 Nov 29;68(11):1367-1372. Available from: 10.1507/endocrj.EJ21-0498.

Case eight

Early career

Sulochi Subasinghe

Use of FreeStyle Libre 2 glucose monitoring to optimise diabetes management

Introduction

This case study presents a 72-year-old gentleman named John. He is a retiree, living with his partner, Bev. John was diagnosed with type 2 diabetes more than 30 years ago. John is on oral hypoglycaemic agents, glucagon-like peptide-1 (GLP-1) agonist weekly injection, and multiple daily insulin injections for diabetes management. His most recent pathology reports in October 2023 indicated suboptimal diabetes management with HbA1c 9.9%. John is a regular client of Better Health Network (BHN) podiatry services. As per the podiatry records, John has a high-risk foot, peripheral neuropathy, and a reduced vascular foot status. Due to a history of ulceration on L/hallux, he is regarded as high-risk. John previously had diabetes education encounters; however, he was not very keen on re-engaging with diabetes education services. His podiatrist is a senior clinician at BHN, and he introduced me to John during the podiatry consultation. After the brief introduction, John agreed to see a CDE for an assessment.

Assessment

John does not smoke, drink alcohol, or take illicit drugs. He has been overweight since the age of 15, peaking at 147 kg 25 years ago. He progressively lost weight with the help of physical activity and GLP-1 agonist. He was on Dulaglutide 1.5 mg (Trulicity) for about three years and changed to Semaglutide (Ozempic) in 2023.

At the diabetes initial assessment on 7 February 2024, he weighed 118 kg.

John's medical history:

- Long standing type 2 diabetes (more than 30 years)
- Peripheral neuropathy
- Sleep apnoea
- Overweight
- Hypertension

John's medications listed below:

- Gliclazide 60 MR: one daily
- Jardiance 25 mg: one daily
- Metformin 1000 mg: one b.d.
- Ryzodeg 70/30: 32–33 Units at breakfast and dinner
- Ozempic 1 mg: one weekly

Other medications:

- Atozet 10/10: one daily
- Candesarten HCTZ 32/25: one daily
- Asprin 100 mg: one daily
- Atenolol 50 mg: 0.5 tablet daily
- Vitamin D 1000 IU: one daily

At the clinic presentation, John was not checking his BGLs at home. He was reluctant to finger prick; however, since I had a discussion with John, he agreed to start a FreeStyle Libre 2 trial.

John agreed to use the Libre sensor and reader trial for two weeks starting 7 February 2024. He didn't want to use a smartphone, as his use of a mobile phone is limited. Education for using a sensor and reader has been provided to John and key features such as glucose reading with trend arrows, alarm alerts, and data sharing were discussed. I encouraged him to scan and check BGLs at least eight times per day. Most importantly, check BGLs before injecting insulin. John had been injecting insulin without checking his BGLs, which is an unsafe practice that puts him at risk of hypoglycaemia.

John presented to the clinic on 14 February 2024 due to his sensor falling off the arm four days after the trial initiation. He was able to contact Abbott's customer care and order a replacement sensor. I assisted John with sensor application and initiation. This time, we decided to tape the sensor to the arm to avoid it falling off. Also, the education session about how to use the sensor was repeated.

As per the records of the first few days, his BGLs ranged between 4 and 15 mmol/L during the day. At night, his BGLs went down to 3.2 mmol/L and the hypoglycaemia alarm went off several times, but the morning readings were higher. After breakfast, the readings increased, followed by lunch and again, BGLs hit 15 mmol/L in the afternoon.

Parallel to the trial, John documented the testing outcomes of changes in medication dosages, food type, portion size, and activity to understand BGL impact. After the first week, he shared this information with a clinical practitioner. According to the data, recommendations were made that the food types were appropriate, but better portion control was needed. A separate dietitian referral was not necessary as the CDE works in both diabetes education and dietetic capacity. A comprehensive dietary assessment was made simultaneously with the CDE review.

John started using a sliding scale of Ryzodeg at night. He was taking 33 units at the start, gradually scaled down to 28 units.

John had an appointment with the CDE on 28 February 2024 to interpret his AGP Report. Figure 1 shows the sensor data of 14 days (15–28 February 2024). John's TIR was within target was 79% with 18% of high readings. We have discussed further dietary and lifestyle modifications targeting postprandial BGL drops.

Figure 1

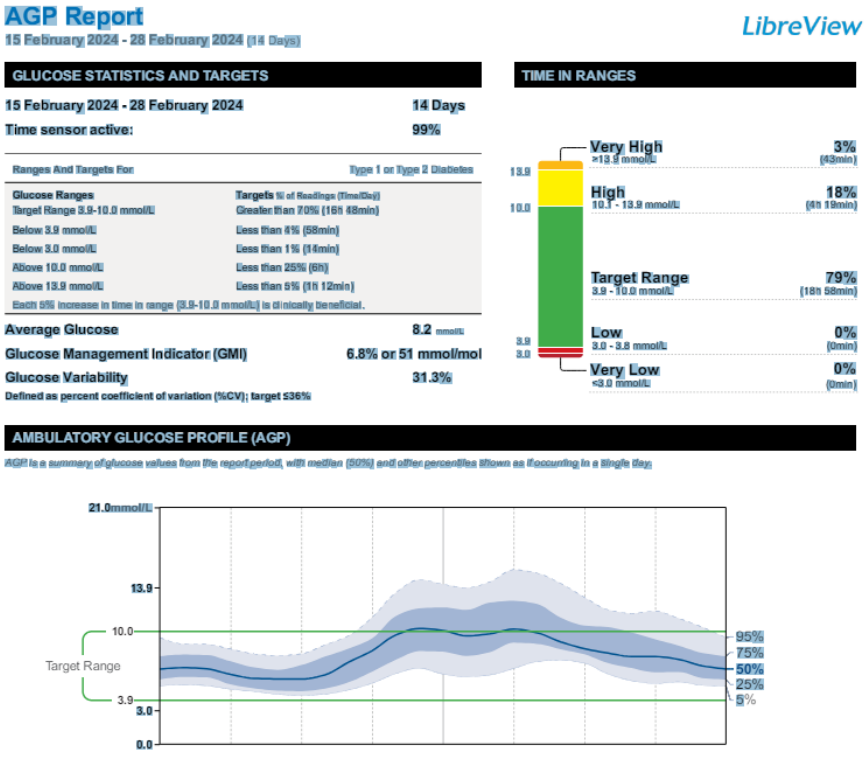

AGP Report
15 February 2024 - 28 February 2024 (14 Days)
LibreView
GLUCOSE STATISTICS AND TARGETS
15 February 2024 - 28 February 2024
14 Days
Time sensor active:
99%
Ranges And Targets For
Type 1 or Type 2 Diabetes
Glucose Ranges
Target Range 3.9-10.0 mmol/L
Targets % of Readings (Time/Day)
Greater than 70% (16h 48min)
Below 3.9 mmol/L
Less than 4% (58min)
Below 3.0 mmol/L
Less than 1% (14min)
Above 10.0 mmol/L
Less than 25% (6h)
Above 13.9 mmol/L
Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.
Average Glucose
8.2 mmol/L
Glucose Management Indicator (GMI)
6.8% or 51 mmol/mol
Glucose Variability
31.3%
Defined as percent coefficient of variation (%CV); target ≤36%
TIME IN RANGES
13.9
10.0
3.9
3.0
Very High
>13.9 mmol/L
3%
(43min)
High
10.1 - 13.9 mmol/L
18%
(4h 19min)
Target Range
3.9 - 10.0 mmol/L
79%
(18h 58min)
Low
3.0 - 3.8 mmol/L
0%
(0min)
Very Low
<3.0 mmol/L
0%
(0min)
AMBULATORY GLUCOSE PROFILE (AGP)
AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.
21.0mmol/L
13.9
10.0
Target Range
3.9
3.0
0.0
95%
75%
50%
25%
5%

Figure 1.1: Indication of overnight hypoglycaemia.

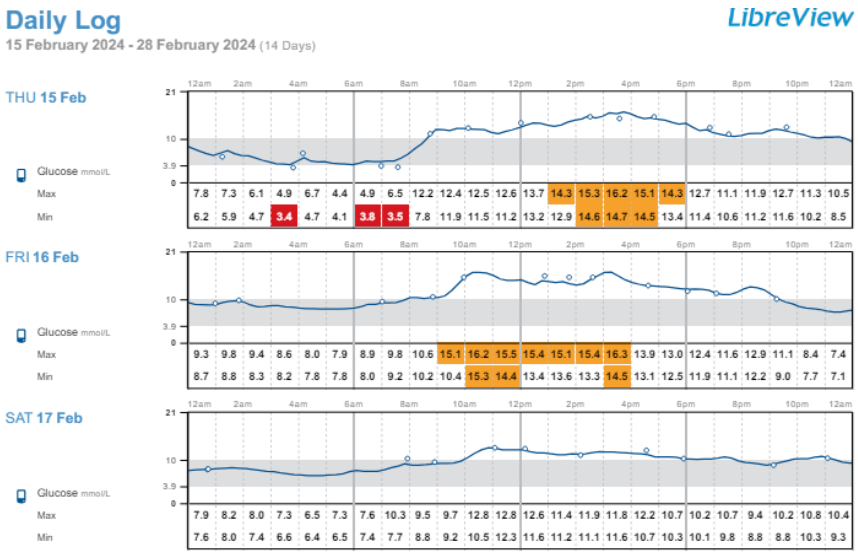
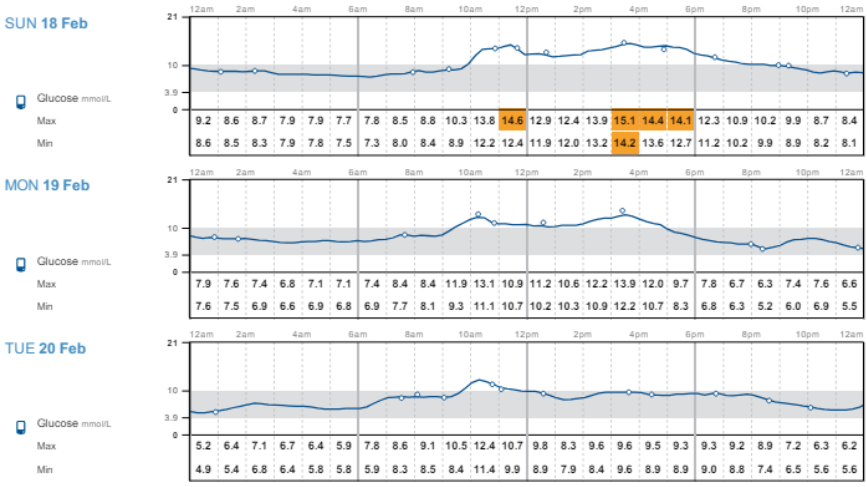
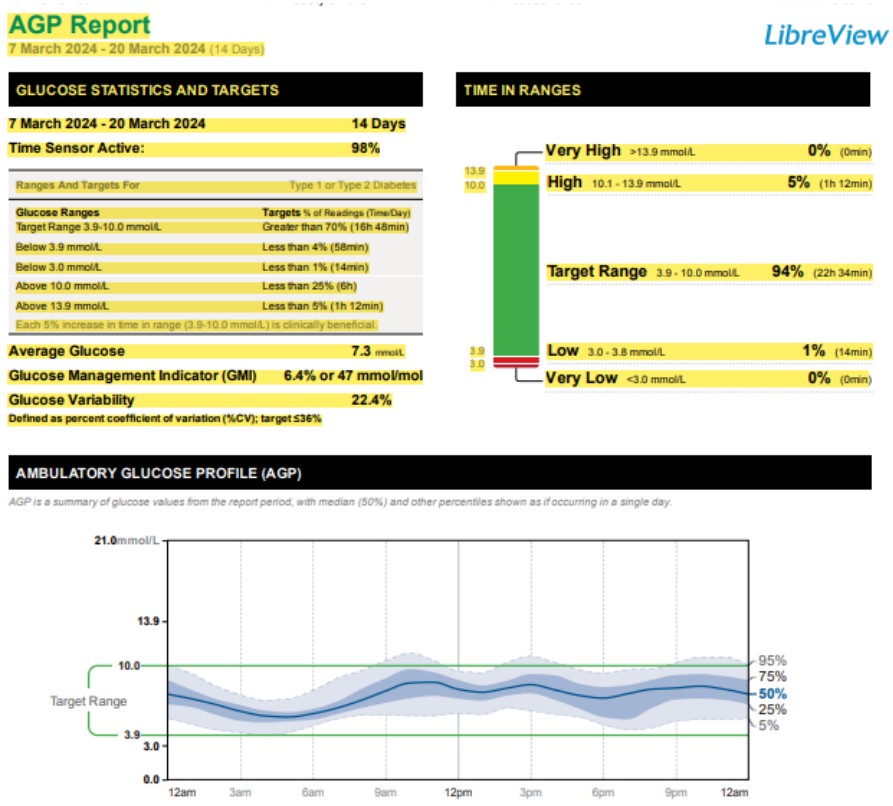


Figure 1.2: Indication of postprandial BGL spike due to high carbohydrate meal choices.



John was happy to get the promotional $15 sensor for another two weeks. He started a new sensor on 6 March 2024 and presented it to the clinic on 20 March 2024 for data review. Figure 2 shows the sensor data for 14 days. His TIR was 94%.

Figure 2



AGP Report

7 March 2024 - 20 March 2024 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

7 March 2024 - 20 March 2024	**14 Days**
Time Sensor Active:	**98%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 3.9-10.0 mmol/L	Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

Average Glucose	**7.3** mmol/L
Glucose Management Indicator (GMI)	**6.4% or 47 mmol/mol**
Glucose Variability	**22.4%**

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES

13.9	**Very High**	>13.9 mmol/L	**0%** (0min)
10.0	**High**	10.1 - 13.9 mmol/L	**5%** (1h 12min)
	Target Range	3.9 - 10.0 mmol/L	**94%** (22h 34min)
3.9	**Low**	3.0 - 3.8 mmol/L	**1%** (14min)
3.0	**Very Low**	<3.0 mmol/L	**0%** (0min)

AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.

Figure 2.1: Indication of overnight hypoglycaemia.

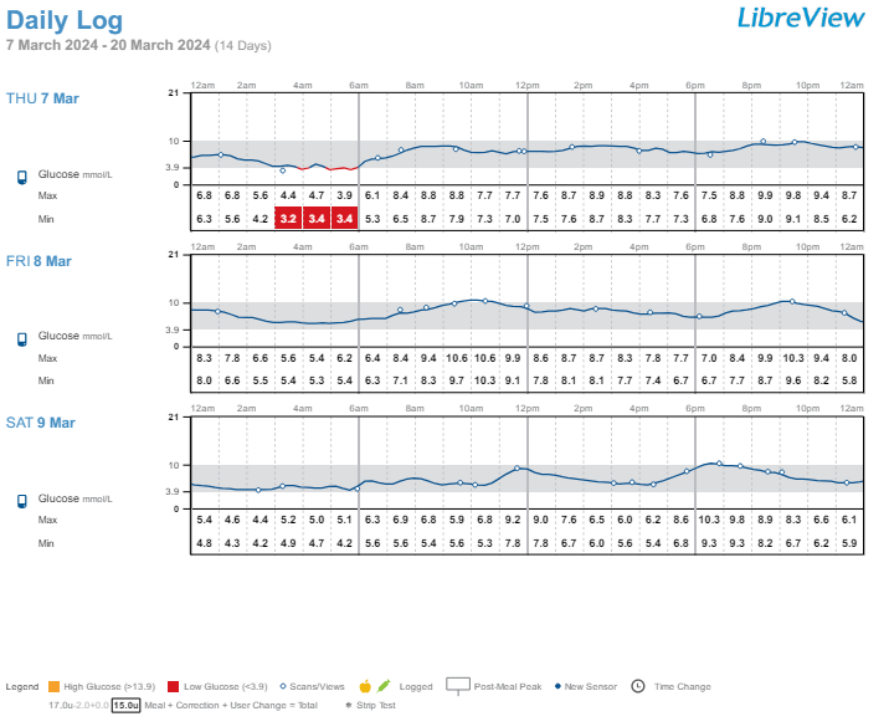
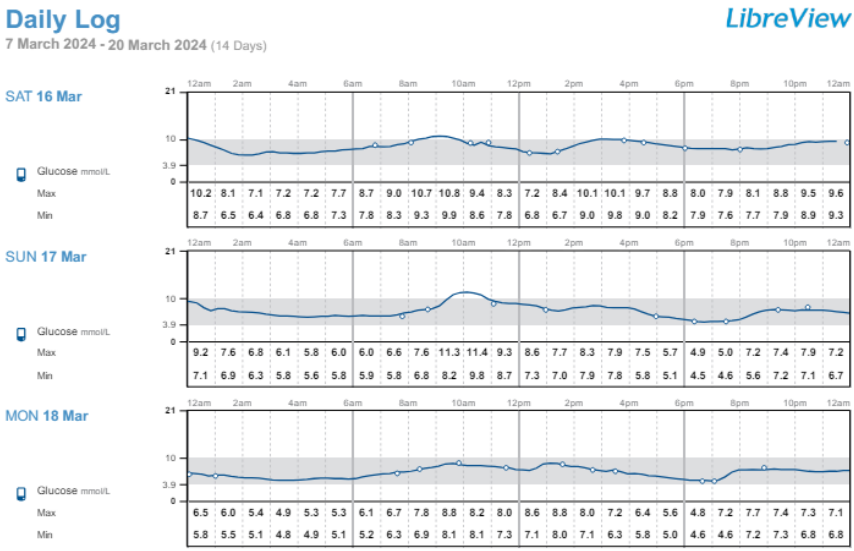


Figure 2.2: Improved glycaemic control.



At the end of the Libre Sensor trial, his nighttime dose of Ryzodeg has been reduced from 33 to 12 units, which has reduced overnight hypoglycaemia and managed BGLs between 4 and 5 mmol/L. With the assistance of food portion control, his daily BG highs now peak at about 10 mmol/L. The other medication change was that Gliclazide MR 60 was moved from evening to morning.

John is gradually reducing his weight. Since his insulin requirement was reduced, his weight reduction was accelerated. By the end of the trial, his weight was down to 111 kg from 118kg. He is so pleased with his progress.

The CDE received an email from John on 8 May 2024, in which he described the list of benefits from the Libre trial. The following paragraph is from John's email.

'By doing the Abbott trial, I have recognised the following benefits:

- *My diabetes is far more controlled in a relatively narrow band.*

- *My Ryzodeg intake has been reduced by 38 units per day (saving the health system money). In December 2022 I was injecting 40 units in the morning and 40 units at night, today I am injecting 30 units in the morning and 12 units at night of Ryzodeg giving me far better diabetic control.*
- *My understanding of the relative value of exercise has increased (4000 steps equals about a 1 to 1.5 blood glucose drop).*
- *My food intake, snacking and portion control is much improved.*
- *I have also learnt about foods that cause spikes in blood glucose (e.g. unsweetened orange juice or a hot cross buns).'*

John presented to the clinic on 10 May for a post-Libre trial review. He had pathology done and saw his endocrinologist in April 2024. As reported, HbA1c came down to 8.1% and through the day, BGLs ranged from 4–11 mmol/L. He does not have hypoglycaemia anymore. His insulin dose, Ryzodeg 70/30 flex touch, down to 12 units at night and 30 units in the morning. Both John and his endocrinologist are pleased with the outcomes of the flash glucose monitoring intervention.

Conclusion

FreeStyle Libre flash glucose monitoring improved John's diabetes control and his quality of life. The data obtained from the Libre Sensor was greatly helpful for John and his healthcare professionals to make informed decisions about his medication needs. Prior to the CDE engagement, John had lost confidence in healthcare professionals due to various reasons. Since he has had a Libre trial, working collaboratively with a CDE to achieve successful outcomes, John has regained confidence in his team and is engaging in diabetes management. The CDE and John discussed a client-centred diabetes management plan to further improve his diabetes management.

John could not afford to wear the Libre sensor continuously due to financial limitations. However, he is happy to wear it intermittently (his budget allows him to wear it once every three months) to measure the effectiveness of diabetes management strategies. He will constantly work on dietary and

lifestyle modifications and use the Libre Sensor once every three months to obtain data for evaluating the effectiveness of lifestyle modifications.

John feels he has more control and empowerment over his diabetes management after using the sensor. He is optimistic about the future of people living with type 2 diabetes using the Libre Flash glucose monitoring system. He believes that if the government subsidises the use of the Libre Sensor for people with type 2 diabetes, it would significantly improve their diabetes management and wellbeing.

Case nine

Early career

Edith Wilson

FreeStyle Libre 2 — relieving diabetes burden

Introduction

TW is a 57-year-old man who lives with type 2 diabetes diagnosed in 2012. TW lives alone and has a very busy work life. He often eats out or skips meals.

TW was encouraged by his GP to see me, a diabetes educator and pharmacist, working at his local pharmacy, to assist with optimising his BG management. During the initial consultation in November 2023, TW expressed frustration about trying to fit in his busy work schedules and medical appointments between his GP, medical specialists, and allied health professionals (e.g. podiatrist). He expressed reluctance to see any additional medical specialists and stated that he has trouble developing a rapport with his GP. He refused to see an endocrinologist due to his already busy schedule.

Our agreed goals were to improve his BGLs, to help reduce the risks and severity of the diabetes-related complications that he was already dealing with and concerned about. A diabetes MedsCheck was conducted at this first appointment to establish his understanding about the purpose, use, and storage of his medications, and to identify any potential issues with these medications[1]. His HbA1c was 10.1% and his BMI was 34.3.

His medical history includes:

- 2012: Type 2 diabetes
- 2012: Hypercholesterolemia
- 2012: Hypertension
- 2019: Diabetic peripheral neuropathy — TW describes intermittent shooting pain in lower legs.
- Jul 2021: Myocardial infarction — requiring six coronary artery bypass

grafting
- Aug 2021: Gastro-oesophageal reflux disease
- May 2022: Ischaemic heart disease (IHD)
- Jun 2023: Pneumonia
- Aug 2023: Nephropathy — chronic kidney disease with glomerular filtration rate (GFR) 21
- Aug 2023: Anxiety
- Jan 2024: Peripheral artery disease — narrowing of arteries in both legs requiring stents in Dec 2023.

Current medications

• Amlodipine 5 mg	one daily
• Aspirin 100 mg	one daily
• Atorvastatin 80 mg	one daily
• Candersartan 4 mg	one daily
• Fenofibrate 145 mg	one daily
• Frusemide 40 mg	one morning
• Jardiance 25 mg	one morning
• Lyrica 75 mg	one night
• Nebivolol 1.25 mg	one daily
• Neo B12 inj.	one every three months
• Pantoprazole 40 mg	one daily
• Ryzodeg 70/30 Penfill	eight units with breakfast and 10 units with dinner
• Trajenta 5 mg	one daily
• Viagra 50 mg	one prn

Assessment

Prior to June 2023, TW's diabetes was managed by oral hypoglycaemic medication, Trajenta, and without any SMBG. He was unable to tolerate metformin.

During hospitalisation for pneumonia in June 2023, TW started Ryzodeg 70/30 insulin — eight units with breakfast and 10 units with dinner. His BGLs quickly returned to target (4–10 mmol/L), and he recovered from the pneumonia. Following discharge from hospital, he was not regularly performing

many SMBG. When asked about this, he was reluctant to talk about it. He admitted he skipped meals from time to time, and he did not see the need for SMBG. The risks of hypoglycaemia with insulin therapy and the importance of SMBG were reinforced, but he still expressed reluctance to undertake finger pricking. He explained he often goes out, and that finger pricking does not fit in his busy work and social life. FreeStyle Libre 2 was suggested to him as an alternative to SMBG. He was open to this suggestion, and I was able to discuss the following aspects with him while sharing the extensive information and support available via the FreeStyle Libre website:

- The convenience of interstitial fluid (ISF) glucose reading from a small sensor connected to his smartphone.
- The App, LibreLink, needed on his smartphone to connect with the sensor.
- Reduced need for finger pricking.
- Reassurance about the accuracy of the ISF glucose readings.
- The alarm alerts that can warn him of impending and/or current hypoglycaemia episodes.
- The trend arrows and various data views such as daily pattern and TIR.
- Cost.
- How to access and order the sensors.

After a short discussion, TW expressed that he was willing to try this technology. TW installed the FreeStyle LibreLink App on his smartphone, and I assisted him to locate the FreeStyle Libre website where he was able to watch the 'Applying the FreeStyle Libre 2 sensor' video[2]. After watching the video, TW applied his first sensor correctly during the consultation with my support and encouragement. I had been able to obtain the sensor sample stock from the FreeStyle Libre company, Abbott Diabetes Care. We went through the App features together and I worked with him to set up:

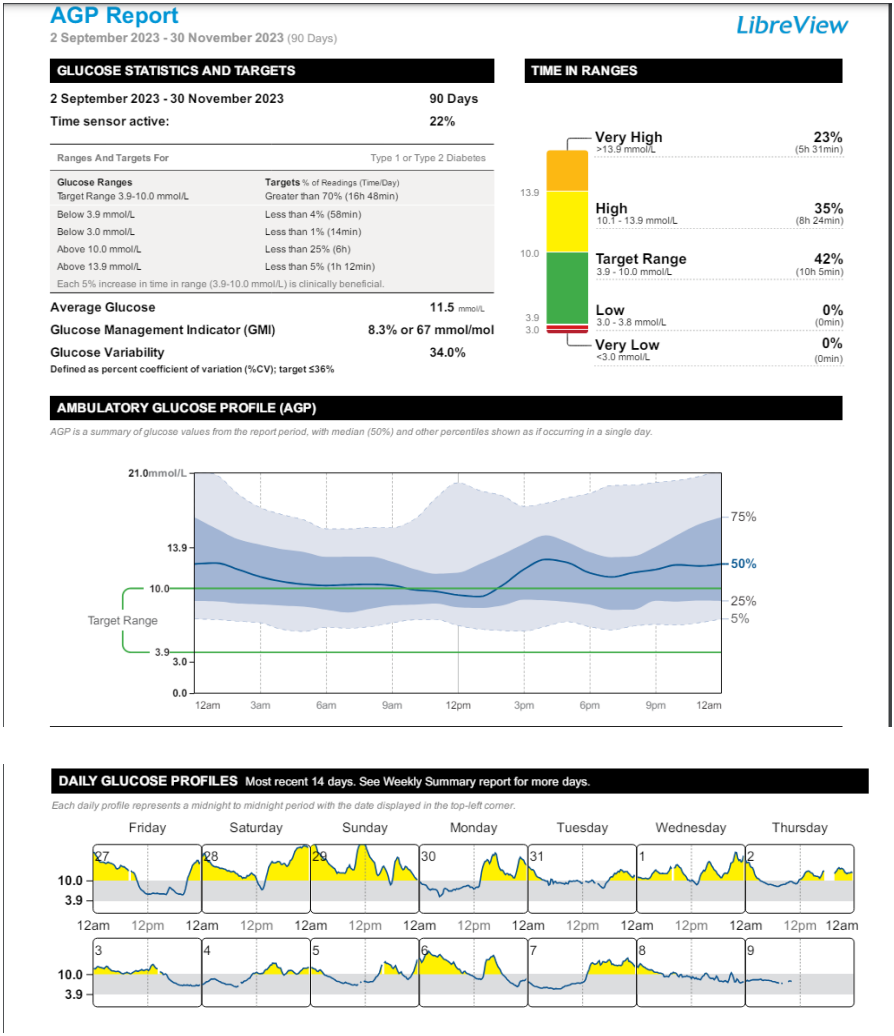
- His target range (3.9–10 mmol/L) as per the type 2 diabetes–management handbook by the Royal Australian College of General Practitioners (RACGP)[3].
- The low glucose alarm was set to 5 mmol/L with both sound and vibration.
- Signal loss alarm was turned on to enable continuous readings.

TW was shown how to locate and interpret the various graphs and data patterns available on the app. We discussed the importance of cross checking the SG reading by performing finger prick tests to confirm hypoglycaemia or impending hypoglycaemia, or if he experiences symptoms not matching the SG readings[4]. A consultation with a dietitian was encouraged for better understanding of healthy nutrition and diabetes, but he kindly declined due to his busy schedule. He was booked to return for a review in two weeks when the sensor was due to be changed.

Management

At the first review appointment two weeks later, TW shared his excitement about being able to see his glucose levels 24 hours a day without pricking his fingers. He had checked his readings 40 times the first day and 76 times the next day! TW's first AGP Report is shown in figure 1.

Figure 1

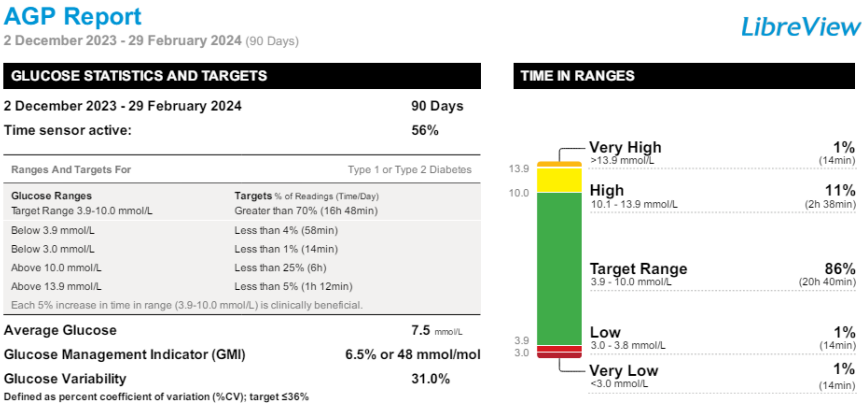


TW reported being more aware of his eating habits as he could see the patterns and trend arrows before and after meals. After exploring the raised postprandial glucose levels seen on the daily glucose profile data, TW stated that he had not been taking any insulin since hospital discharge, because he

never eats breakfast at home and only did so while in hospital. After explaining the importance of insulin, and how it works for him and his diabetes management, he was willing to start taking insulin injections and eating a light breakfast; he continues to take his insulin with dinner. During the consultation, TW changed his sensor to a new one he had purchased online with some gentle reminders about the procedure.

At his third appointment in December 2023, we reviewed together how FreeStyle Libre 2 has helped him see the impact of food and exercise on his BG. He talked about his experiments with different foods and how he had started exercising 30 minutes a day on average. The daily glucose profiles he looked at on the app have helped him identify changes in his glucose patterns and trends because of these lifestyle changes. This motivated him to keep improving his lifestyle for optimal diabetes management. His AGP Report on the third visit is shown in figure 2.

Figure 2



AGP Report

2 December 2023 - 29 February 2024 (90 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

2 December 2023 - 29 February 2024	**90 Days**
Time sensor active:	**56%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 3.9-10.0 mmol/L	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

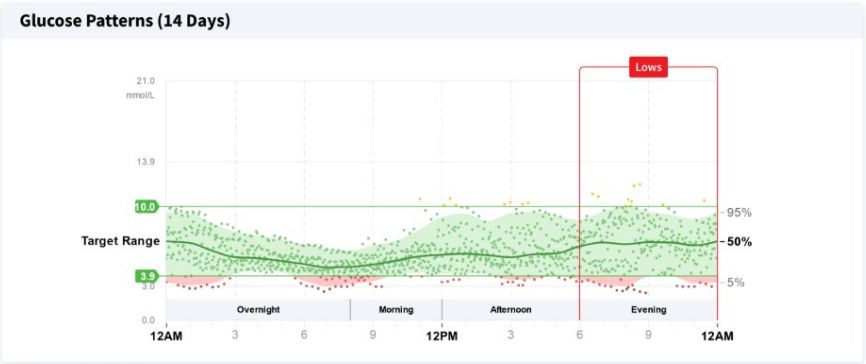
Average Glucose	**7.5** mmol/L
Glucose Management Indicator (GMI)	**6.5% or 48 mmol/mol**
Glucose Variability	**31.0%**

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES

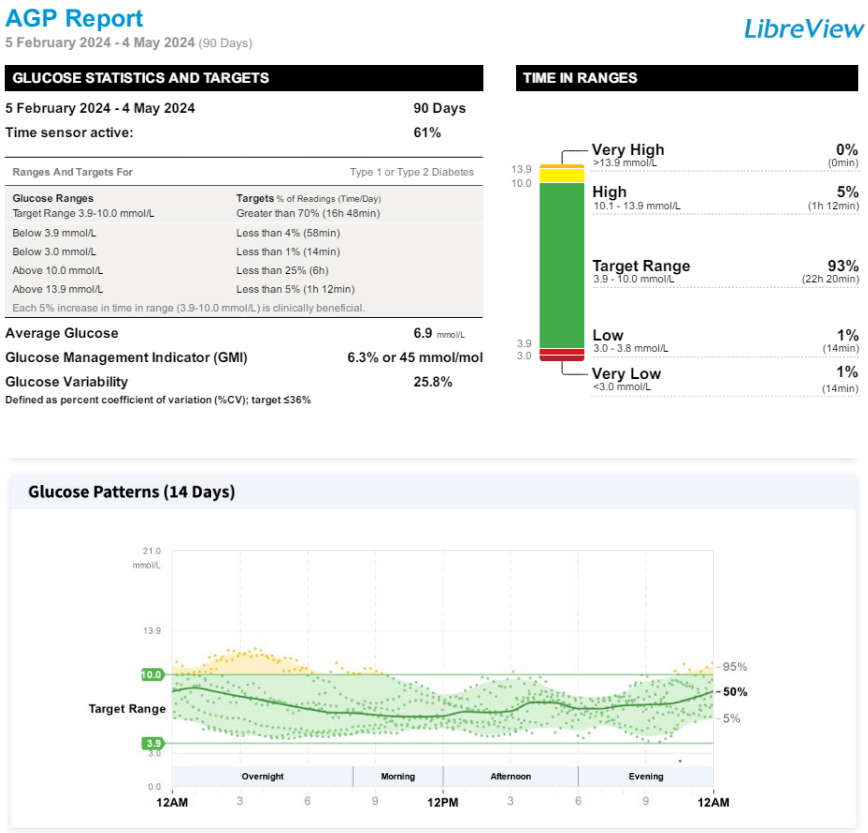
13.9
10.0
3.9
3.0

Very High	>13.9 mmol/L	**1%** (14min)
High	10.1 - 13.9 mmol/L	**11%** (2h 38min)
Target Range	3.9 - 10.0 mmol/L	**86%** (20h 40min)
Low	3.0 - 3.8 mmol/L	**1%** (14min)
Very Low	<3.0 mmol/L	**1%** (14min)



It was encouraging to see his TIR had increased from 42% to 86% in two weeks. Unfortunately, a significant number of hypoglycaemic episodes were observed. This is an adverse outcome with serious safety considerations and requires urgent attention. During our discussion about these hypoglycaemic events, he revealed he was injecting insulin without eating. I was able to remind him about how important it is to have food with Ryzodeg as it has a rapid-acting insulin component. We also discussed hypoglycaemic treatment and driving safety[5]. On his most recent visit in May 2024, his AGP Report is shown in figure 3.

Figure 3



There were significantly reduced hypoglycaemic episodes according to the glucose patterns, and he achieved 93% TIR.

Conclusion

FreeStyle Libre had lifted TW's self-efficacy in managing his diabetes. Most importantly, since he used FreeStyle Libre, he had reduced the risks of worsening his diabetes-related complications. This CGM device notably

reduced diabetes distress and emotional burden for TW, a person with type 2 diabetes on insulin[6].

References

1. Department of Health and Aged Care. MedsCheck and Diabetes MedsCheck: Australian Government; 2023 [updated June 2023]. Available from: https://www.health.gov.au/our-work/medscheck-and-diabetes-medscheck.

2. Abbott Diabetes Care. Apply the FreeStyle Libre 2 sensor. 2024. Available from: https://www.freestylelibre.com.au/video-guides.

3. Royal Australian College of General Practitioners, Diabetes Australia. Management of type 2 diabetes: A handbook for general practice. 2021.

4. Abbott Diabetes Care. Full indications and important safety information FreeStyle Libre 14 day. 2024. Available from: https://www.freestyle.abbott/us-en/safety-information.html.

5. Diabetes Australia. Driving with diabetes. 2024. Available from: https://www.diabetesaustralia.com.au/living-with-diabetes/driving/.

6. Soriano EC, Polonsky WH. The influence of real-time continuous glucose monitoring on psychosocial outcomes in insulin-using type 2 diabetes. J Diabetes Sci Technol. 2023;17(6):1614-22.

Case ten

Early career

Amy Zheng

Revealing the unexpected: technology's role in discovering secondary causes of hyperglycaemia

Introduction

In my role as a Diabetes Nurse Educator (DNE) at a tertiary service, one of my duties is to stabilise insulin therapy according to established protocols. I work with a multidisciplinary team of endocrinologists, an NP, diabetes educators, psychologists, dietitians, and social workers.

CGM devices have advanced significantly in the last decade. This case study illustrates the benefits of using these devices in diabetes management by empowering patients to self-manage their diabetes with confidence, while also offering significant benefits from a clinical standpoint in terms of patient care management. Additionally, an interesting finding in this case study was the use of CGM to aid clinical decisions in detecting other potential causes of hyperglycaemia that are less commonly encountered in routine practice.

Mary (pseudonym) is a 60-year-old woman who works full-time as an administration officer. She lives alone but has good family support with two sons living nearby. She was referred to our service by her GP due to ongoing suboptimal HbA1c levels despite maximised pharmacotherapies. Following an endocrinologist's review, she was referred to me to stabilise insulin therapy to achieve target BGLs.

Assessment

Mary's initial face-to-face appointment revealed a borderline blood pressure of 140/90 and a BMI of 39.1. Recent pathology findings showed an elevated HbA1c of 10.1% and reduced eGFR of 32 mL/min/1.73m^2. She has multiple chronic conditions that are being managed with polypharmacy. Diabetes mediation included: Sitagliptin/Metformin XR 50 mg/1000 mg 2 tabs OD,

Gliclazide 120 mg OD mane, Ozempic 0.5 mg SC injection/weekly, Toujeo 50/x/x/90, NovoRapid 50/50/50/x. She was also previously prescribed an SGLT2 inhibitor; however, it was discontinued due to severe thrush.

Mary and I identified some key issues with her current management, which included waking up at night from frequent hypoglycaemic symptoms requiring treatment with quick-acting carbohydrates; irregular self-monitoring of blood glucose (SMBG) due to pain and the inconvenience of finger pricking, particularly when she is at work; erratic BGLs ranging from 2.3–20.2 in the past two weeks as recorded in her logbook; and often forgetting to take lunch-time insulin at work.

Management

During our initial consultation, Mary revealed that she was distressed by the challenges of managing her diabetes, including frequent BGL monitoring (4–8 times a day) and adhering to multiple medication regimens. She was particularly anxious about the night-time hypoglycaemias episodes, which made her fearful of sleeping, especially when she is living alone. This fear resulted in sleep disturbances which subsequently affected her daytime energy levels, mood, and worsened her hyperglycaemia.

An assessment was conducted to ensure that the basics of insulin injection techniques were correct before implementing interventions. Mary was asked to demonstrate her injection technique and to check for any lipohypertrophies that might hinder insulin absorption. Additionally, a basic lifestyle review was performed, and no alarming issues were detected.

Mary and I both agreed that our initial priority was to address the hypoglycaemia to alleviate its unpleasant symptoms and reduce the potential complications of recurrent hypoglycaemia. The FreeStyle Libre was chosen due to its free trial offer for people using insulin. I explained to Mary how the FreeStyle Libre could help prevent hypoglycaemia by providing information about BGL trends. I also highlighted the option to set a low-glucose alarm on her mobile app, which would alert her if her levels were falling thereby easing her anxiety before going to bed. Following our discussion, a Libre sensor was applied and connected to our service's LibreView for remote access. This

functionality also improved access to care for Mary, who lived a 1.5-hour drive away from our service.

With remote access to Mary's device, I was able to identify patterns and explore potential causes that could lead to her night-time hypoglycaemia (figures 1 and 2). As a result, a dietitian appointment was made to enhance Mary's knowledge in recognising carbohydrates, especially for dinner times as she occasionally skips carbohydrates, unintentionally. Gliclazide was ceased by the endocrinologist, NovoRapid was reduced from 50 units to 35 units three times per day, evening Toujeo reduced from 90 units to 80 units.

Figure 1.: Identified hypoglycaemia patterns.

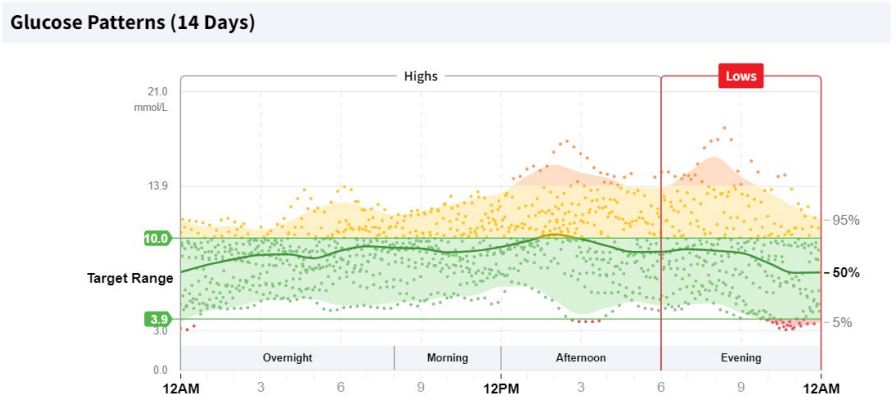
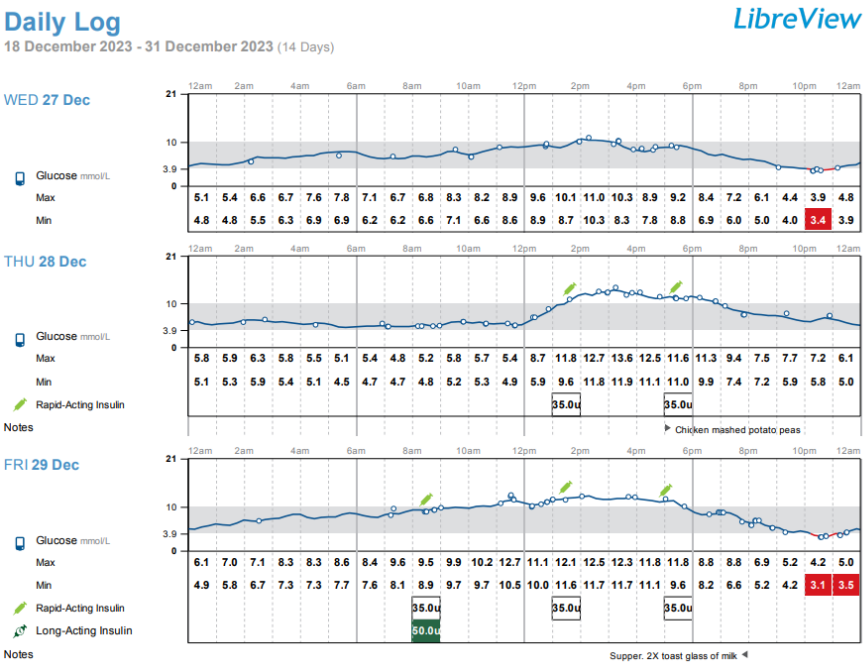


Figure 2: Hypoglycaemia.

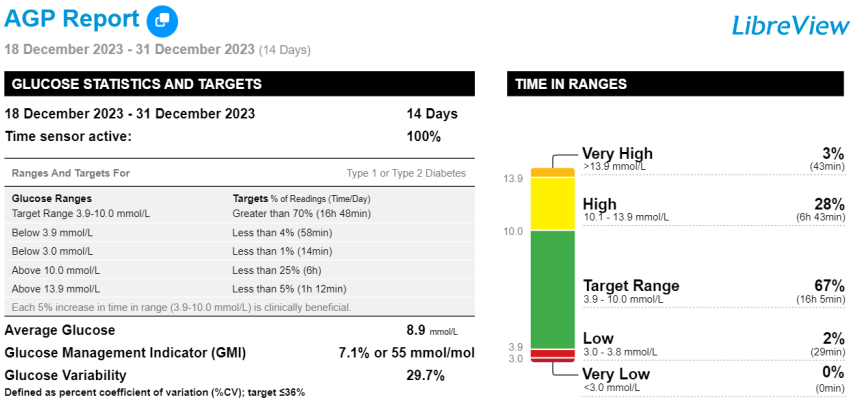


The initial AGP indicated a predicted GMI of 7.1% (figure 3), indicating a significant improvement compared to the baseline HbA1C reading of 10.1%. However, I have come to appreciate that time below range was more crucial in Mary's case. While an improved HbA1c is linked to reduced long-term complications, it is essentially an average value that would not have highlighted Mary's hypoglycaemia without the use of continuous glucose monitoring. The combination of interventions of ceasing gliclazide, carbohydrate adjustments at dinnertime and reducing insulin dosage, proved effective as hypoglycaemia was significantly reduced in the following week (figure 4).

At this point, Mary expressed high satisfaction with the amount of information the Libre device provided, enhancing her understanding of the cause and

effect of her BGLs without the need for finger pricking. She also reported improved sleep without having to wake up to treat her hypoglycaemia, leading to better mood and daytime energy levels. She continued to purchase the FreeStyle Libre sensors after the initial free trial due to the positive experience.

Figure 3: First AGP two weeks after using the Libre FreeStyle.



AGP Report

18 December 2023 - 31 December 2023 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

18 December 2023 - 31 December 2023	14 Days
Time sensor active:	100%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 3.9-10.0 mmol/L	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

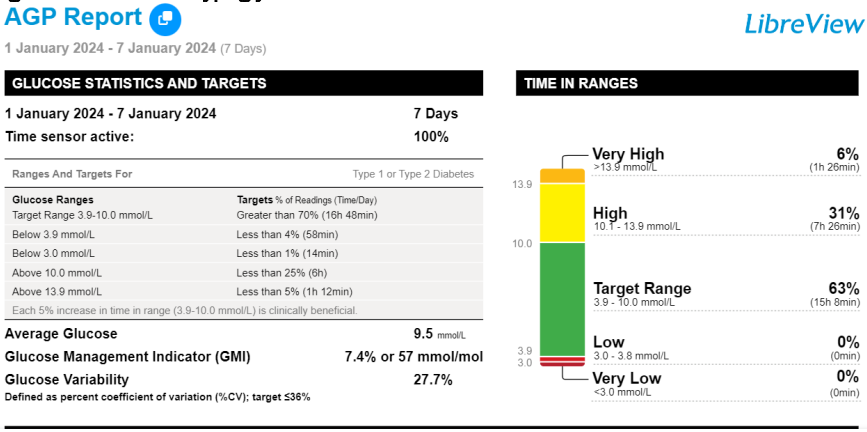
Average Glucose	8.9 mmol/L
Glucose Management Indicator (GMI)	7.1% or 55 mmol/mol
Glucose Variability	29.7%

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES

13.9	Very High >13.9 mmol/L	3% (43min)
	High 10.1 - 13.9 mmol/L	28% (6h 43min)
10.0	Target Range 3.9 - 10.0 mmol/L	67% (16h 5min)
3.9	Low 3.0 - 3.8 mmol/L	2% (29min)
3.0	Very Low <3.0 mmol/L	0% (0min)

Figure 4: Corrected hypoglycaemia.



AGP Report

1 January 2024 - 7 January 2024 (7 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

1 January 2024 - 7 January 2024	7 Days
Time sensor active:	100%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 3.9-10.0 mmol/L	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

Average Glucose	9.5 mmol/L
Glucose Management Indicator (GMI)	7.4% or 57 mmol/mol
Glucose Variability	27.7%

Defined as percent coefficient of variation (%CV); target ≤36%

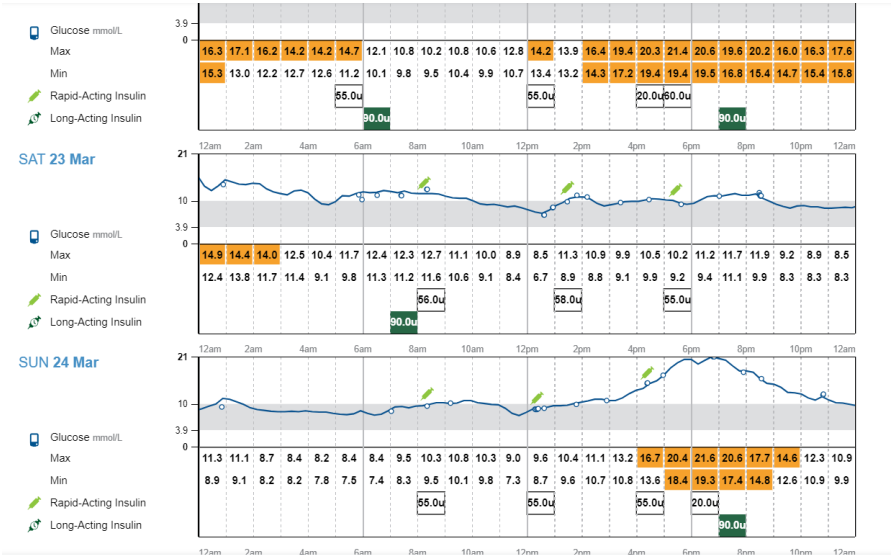
TIME IN RANGES

13.9	Very High >13.9 mmol/L	6% (1h 26min)
	High 10.1 - 13.9 mmol/L	31% (7h 26min)
10.0	Target Range 3.9 - 10.0 mmol/L	63% (15h 8min)
3.9	Low 3.0 - 3.8 mmol/L	0% (0min)
3.0	Very Low <3.0 mmol/L	0% (0min)

Mary was monitored with weekly phone calls over the next three months to stabilise her insulin. However, her erratic BGLs remained a concern, as they were often difficult to stabilise without clear reasons. As a result, she was scheduled for an endocrine review and advised to visit her GP for pathology testing before the appointment.

The FreeStyle Libre system also played a crucial role in clinical decisions when we found Mary's estimated Glomerular Filtration Rate (eGFR) had dropped to 20 mL/min/1.73m^2 during the pathology testing. This finding led to the discontinuation of all oral diabetes medications due to contraindications. Consequently, it was expected that Mary's BGLs would rise, and given her susceptibility to hypoglycaemia, the team decided for Mary to go on to flexible dosing. It was also recommended for Mary to use NovoPen 6 for more precise injection data and safer correction doses. This insulin pen's ability to record dosing history proved particularly beneficial for Mary, who occasionally forgets to take her lunchtime insulin. The NovoPen 6 has also helped Mary learn how to administer correction doses effectively. The integrated technology of NovoPen 6 and FreeStyle Libre supported Mary's transition to a flexible insulin dosing regimen by providing crucial data that would have been challenging and potentially unsafe to manage otherwise. This functionality also allowed the team to monitor the exact amount of insulin administered (figure 5).

Figure 5: Erratic BGLs after cessation of all oral hypoglycaemics (OHGs), clear logging of NovoRapid by using the NovoPen 6 Pen, evidence of self-efficacy in giving correction doses.



Despite Mary's diligence in diabetes management, her BGLs remained erratic with no obvious pattern as observed in her CGM data (figure 5), even with high insulin dosing (confirmed by the NovoPen 6 data logging) and correct carbohydrate estimation (given by the dietitian). This inconsistency prompted the team to further investigate. After multiple investigations, it was found that Mary could potentially have Cushing's syndrome as her renal CT showed an incidental finding of bilateral adrenal nodules. The challenges in stabilising glycaemia with Cushing's are well-documented, as excess cortisol can lead to persistent hyperglycaemia through pathophysiology such as insulin resistance, increased hepatic glucose production, and impaired glucose tolerance[1]. This finding was a major turning point for our team as we identified a secondary cause of Mary's hyperglycaemia.

As Mary's case became more complex and involved factors beyond type 2 diabetes, her care was transferred to the chronic and complex team. Despite encountering various challenges in adjusting her insulin therapy over a three-

month period, both Mary and I were pleased with the insights provided by the Libre system in supporting her self-management.

Conclusion

The Libre system has empowered Mary to visualise and understand the multiple aspects of diabetes management such as the impact of medications, stress, sleep, carbohydrate intake, and physical activity on her BGLs. This understanding of the cause-and-effect relationship has significantly changed some of Mary's behaviours. The Libre system also helped me, as a DNE, to correlate Mary's BGLs with daily activities, food intake, and troubleshooting areas to improve her diabetes management. By recognising these patterns, we could adjust her insulin doses safely, leading to improved glycaemic control. This has empowered me as a DNE to support my patients more effectively with greater precision and confidence.

This experience has prompted me, as a DNE, to realise that the 'typical' patient scenario of unmanaged type 2 diabetes due to obesity and insulin resistance may not always apply. While it is necessary to align the patients with 'typical presentations' with standard treatment algorithms, it is also crucial to think outside the square when treatments do not reach the desired outcomes. Mary was fortunate to have the opportunity to trial the FreeStyle Fibre and NovoPen 6 as they both played pivotal roles in uncovering other potential hyperglycaemia causes, providing crucial data that would have otherwise been unattainable without these technologies.

While Mary's current glycaemic outcomes may not be as optimal as desired, the goal of improving her diabetes self-management was achieved with the use of continuous glucose monitoring. She expressed gratitude for the opportunity to participate in the Libre trial, describing it as a 'life-changing' approach to managing her diabetes.

Reference

1. Sharma A, Vella A. Glucose metabolism in Cushing's syndrome. Curr Opin Endocrinol Diabetes Obes. 2020 Jun;27(3):140–5.

Notes