

FreeStyle living with diabetes: Learning from case studies 2023



Your trusted partner in diabetes care

Acknowledgement

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

- Lorena Akerman, APD CDE
- Ann Bush, RN CDE, ADEA
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- Rachel Freeman, Adv APD CDE
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- Dr Sue-Lynn Lau, Endocrinologist
- Peta Tauchmann, RN CDE

Thank you to those who voted for their favourite case study video and attended the case study session at this year's Australasian Diabetes Congress (ADC).

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About ADEA

The Australian Diabetes Educators Association (ADEA) has been the peak organisation for diabetes education in Australia for 42 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 2,410* members, there are more than 1,630* Credentialed 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.

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**Numbers as of 30 June 2023.*

FreeStyle living with diabetes: Learning from case studies 2023

FreeStyle living with diabetes: learning from case studies 2023 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 Flash Glucose Monitoring¹ and ambulatory glucose profile.²

Submitted case studies include principles of [person-centred care](#) and adhere to the [Diabetes Australia Position Statement: Our Language Matters](#) while discussing the use of Flash Glucose Monitoring and LibreView, which incorporates the AGP Report, whilst addressing the following questions:

1. How has 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 time in range.
7. How has the FreeStyle Libre or Libre 2 helped facilitate FreeStyle living with diabetes?

The top 10 case studies are featured in this booklet. Each submission was assessed by members of the panel of judges in a blind review process.

The top four entries were then selected to create a video for member/peer votes and then present in-person at the Australasian Diabetes Congress 2023 (ADC). The winner of the FreeStyle living with diabetes: learning from case studies 2023 will be decided by peer votes for the case study video (40%) and a panel of judges at ADC (60%).

The case studies are presented in alphabetical order of authors' surnames.

1. *The Flash Glucose Monitoring system utilises a glucose sensor/transmitter and handheld receiver to measure multiple glucose data points from interstitial fluid. The glucose sensor is worn on the arm continuously for 14 days and includes a transmitter to communicate with the handheld glucose device. The handheld glucose receiver is used to manually transfer the data and displays the current glucose level, trend arrow and history of the past eight hours without the need for capillary glucose testing. The receiver may also be used with capillary blood as an insulin dose advisor, however, calibration with capillary blood is not required.*
2. *The ambulatory glucose profile is a software approach to collating and analysing glucose data. It combines glucose readings from multiple days/weeks of glucose monitoring into a single 24-hour period, featuring statistical information such as average, interquartile and interdecile ranges.*

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Case one

Gabriela Abrahamson and Jiahua Wu

Working together to ensure a safe pregnancy — a culturally safe and supportive multidisciplinary team approach to the provision of care for a woman of Aboriginal background

Pre-existing diabetes in pregnancy is associated with adverse neonatal outcomes and long-term risk of cardiometabolic disease for both mother and offspring. Aboriginal women in Australia have the highest reported incidence of pre-existing diabetes in pregnancy.¹

Currently, primary and hospital services operate independently. Effective communication and teamwork between services may be inconsistent. As a result, clients can sometimes feel disempowered and disengaged.²

This case study demonstrates the value of a multidisciplinary team collaboration amongst primary and hospital care teams, utilising innovative technologies in providing person-centred care for a woman of Aboriginal background during her high-risk pregnancy.

Jenny is a 33-year-old Aboriginal woman, relocated to Sydney from the Northern Territory, with her husband and 6-year-old child in 2021. Jenny's medical history consisted of type 2 diabetes and complex high-risk pregnancies.

Jenny was referred by her GP Dr. YZ in July 2022 to our diabetes centre for high-risk pregnancy planning and intervention for her elevated glycaemia, HbA1c 11.3%.

Initial attempts at engagement were declined. The referral was transferred to the Integrated Care Nurse (ICN) who was able to engage Jenny via collaboration with her GP in the community setting. Jenny had developed rapport with her GP and would attend her practice daily. Our diabetes service

was able to utilise this relationship to support Jenny in managing her diabetes, supporting her plans for pregnancy and developing trust in our service.

Regular case conferences were utilised with the aim of optimising glycaemic and medication management with the assistance of Libre Flash Glucose Monitoring (FGM) to ensure the best outcomes for Jenny's pregnancy.

Assessment

Following referral from Dr YZ, Jenny was reluctant to engage with the diabetes and Aboriginal Health Service in the hospital due to diabetes stigma and a lack of trust in health services. For this reason, Jenny avoided attending health services other than her GP, with whom she had developed a strong sense of trust.

The referral was identified as high-risk pregnancy planning, and for this reason was discussed with the ICN who contacted Jenny's GP with the aim of trying to facilitate engagement. Dr YZ confirmed that glycaemic management had improved since original referral with a reduction in HbA1c to 7.3% due to the commencement of oral hypoglycaemic agents, empagliflozin/metformin 12.5 mg/1000mg bd and semaglutide 1mg injection weekly.

Regular case conferences with Jenny, Dr YZ, an endocrinologist, and diabetes educators were commenced, alongside on-site GP practice visits. During the initial video case conference, Jenny's medical history was obtained including class I obesity (BMI: 33.3), vitamin D deficiency and three occasions of preterm birth and stillbirth at 23 weeks gestation. Jenny also reported having limited access to family support, transport, adequate nutrition, and medication due to her financial circumstances.

Management

Our goal was to support Dr. YZ in managing Jenny's diabetes with safe pregnancy outcomes. This was achieved by fostering a strong rapport with Jenny to facilitate effective preparation for her future pregnancy.

Semaglutide and empagliflozin were ceased before conception due to contraindications in pregnancy. We anticipated poor glycaemic control after ceasing both agents and determined that insulin therapy was inevitable.

Dr YZ was hesitant to initiate insulin therapy in the community due to Jenny's limited health literacy, reluctance to monitor her blood glucose levels regularly and limited understanding of the requirements of managing her condition. FGM was recommended to empower and motivate Jenny to self-monitor her blood glucose levels with minimal burden reducing impact of elevated glycaemic control on her pregnancy.³

The use FGM enabled visibility of glycaemic control and clinician confidence in the initiation and titration of insulin therapy (figure 1). This technology also allowed for remote monitoring of Jenny's glucose profile which was highly useful when case conferencing; all health care clinicians were to be able to see and review glycaemic management.

Picture 1: Post ceasing OHA's and GLP1 prior to commencing insulin therapy

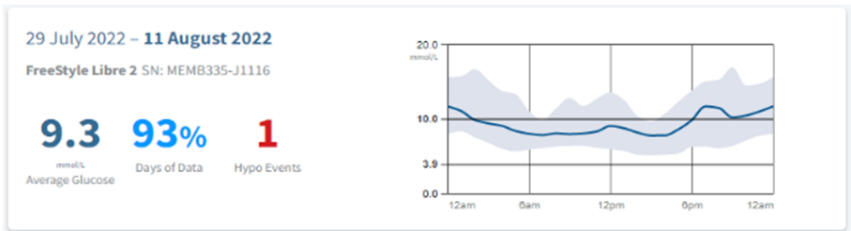


Figure 1: Post ceasing OHA's and GLP1 prior to commencing insulin therapy.

Optimal glycaemic management was achieved by simplifying her insulin regimen to support Jenny's individualised needs, ensuring low diabetes management burden and reduced risk of hypoglycaemia. Novomix30 premixed insulin was utilised to achieve this enabling only two injections a day. Novomix30 is associated with an increased risk of hypoglycaemia and is not commonly used in pregnancy due to fixed ratios preventing flexibility in fine tuning insulin requirements.⁴ However, this insulin regimen was successful

when used with FGM due to enabling a simpler insulin regimen and reduced risk of hypoglycaemia due to visibility of glycaemic levels (figure 2).

Picture 2 Optimal glycaemic control achieved

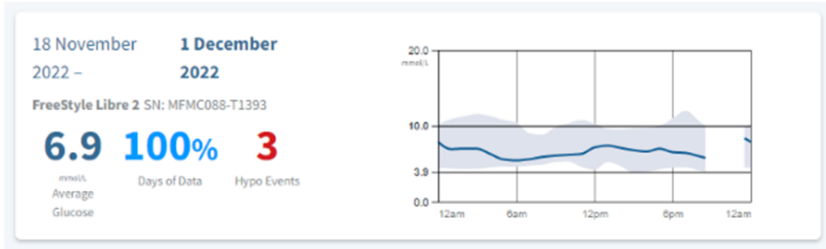


Figure 2: Optimal glycaemic control achieved.

Jenny was reassured that her pregnancy was being closely monitored. FGM gave her confidence and allowed her to see her blood glucose levels. This led to making healthier food choices and taking and adjusting her insulin doses.

FGM monitoring also enabled her health care team to confidently support and advise on optimal medication management for Jenny's diabetes during her pregnancy whilst respecting Jenny's cultural and individual needs. Most importantly, FGM enabled Jenny to receive most of her pre-natal and post-natal care in the community setting where she felt comfortable, and her pregnancy was less medicalised.

Conclusion

Jenny was able to successfully conceive and carry her pregnancy surpassing the gestational age of her previous medically unmonitored pregnancies. Jenny at 25 weeks gestation developed preeclampsia as a comorbidity and delivered a healthy baby boy via caesarean section at 32 weeks gestation weighing 1.1kgs and requiring neonatal intensive care admission for 4 weeks due to prematurity. Jenny was discharged home with plans to cease insulin therapy and recommence pre-pregnancy medication management once breastfeeding

ceased. Jenny's baby boy did not experience any episodes of hypoglycaemia post-delivery and at last review was reaching all milestones.

An integrated collaboration between primary and hospital services is essential to ensure person-centred diabetes care. This case study demonstrates the importance of upskilling primary health care physicians in supporting people with diabetes to improve health outcomes using diabetes technologies such as FGM. Jenny's GP now has the confidence to use new skills in diabetes management for all her clients with diabetes and those using diabetes technologies.

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Case two

Yan Yan Au-Yeung

Using FreeStyle Libre to help people with LADA adapt life changes

Introduction

Working as a diabetes nurse educator (DNE) in the diabetes out-patient clinic setting, my job is providing diabetes self-management education to clients, identifying their needs, and supporting them to adopt their new healthy lifestyles after diagnosis with diabetes.

This case study is about a client called May (pseudonym used), a 58-year-old woman who was diagnosed with Type 2 diabetes mellitus (T2DM) two years ago. She was admitted to hospital in January 2023 with diabetic ketoacidosis (DKA).

During the admission, the blood test results shown her C-Peptide was 0.9 and the Glutamic Acid Decarboxylase Autoantibodies (GAD) test was positive. She was reviewed by an endocrinologist and diagnosed with latent autoimmune diabetes in adults (LADA).

After being discharged from the hospital, she went to see a private endocrinologist for her on-going diabetes management. She was also referred to out-patient diabetes service in the hospital for post discharge follow-up review with DNE and diabetes dietitian.

May is always proactive with her diabetes management since the T2DM diagnosis. She made a lot of dietary changes and cut down carbohydrate consumption. When she learnt she has LADA, she felt she needed more support from the diabetes service team to improve her diabetes management.

May attended her first DNE face-to-face appointment in April 2023 after the new diagnosis.

Assessment

May has a busy lifestyle. She works as a full-time project manager. She has a family history of diabetes as her mother is living with T2DM. She is currently on 1g Metformin twice per day, Optisulin (long-acting insulin) 4 units pre-bed and Novorapid (short-acting insulin) 2 to 4 units at dinner time with high carbohydrate meals. May stated that she was on linagliptin and dapagliflozin for her T2DM management. However, since she was diagnosed with LADA and started on insulin, her endocrinologist ceased those two medications as they might increase the risk of hypoglycaemia.¹

May was checking her blood glucose levels (BGL) three times per day with a glucometer and fingerpicking, ranging from 5.2-13.3 mmol/L throughout the day. She took insulin and medication regularly. However, she has been restricting her food intake, especially carbohydrate food, to maintain her BGLs within the optimal range.

May is physically active. She went for a 5 km run weekly. She also attended pump classes and cardio workout exercises at the gym four times per week. She has experienced some hypoglycaemia episodes during work time and at midnight after going to the gym on that day.

Management

May was recommended by the endocrinologist to start on a 2-weeks trial of the Freestyle Libre 2 sensor. During the initial consultation, education about how to use the sensor, applying the sensor and setting up with the Libre Link mobile application (App) were provided. A Freestyle Libre 2 reader was provided to her for ketone checks when she is unwell and her BGL is above 15.0 mmol/L.²

May was advised to eat enough carbohydrates in her meals and use Novorapid insulin. She attended the diabetes dietitian review after and given education on carbohydrate counting.

Two days after May started on the trial, she contacted the clinic because the sensor had stopped working. It showed on the App "Sensor Ended". According

to the Freestyle libre 2 trouble shooting webpage, "Sensor Ended" may mean the Sensor life has ended. I provided Abbott customer support phone number to her and asked her to call for sensor replacement.

May came back to the clinic 4 weeks later for a DNE follow-up review. Figure 1 shows the sensor data of the first 14 days. May's time in range within target was 62%. The time sensor active was 46%. May believed that the sensor active time did not reflect her practice as she was waiting for the sensor replacement from Abbott. She did not want to purchase a new sensor before she completed the trial. Figure 2 shown she did not use any sensor for 7 days.

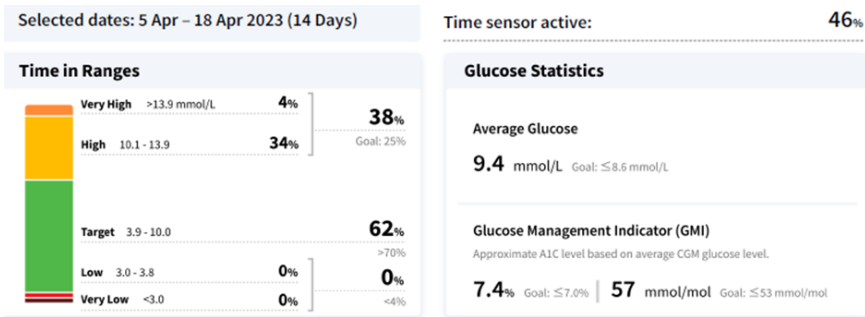


Figure 1: Glucose statistics and time in ranges of the first 2 weeks.

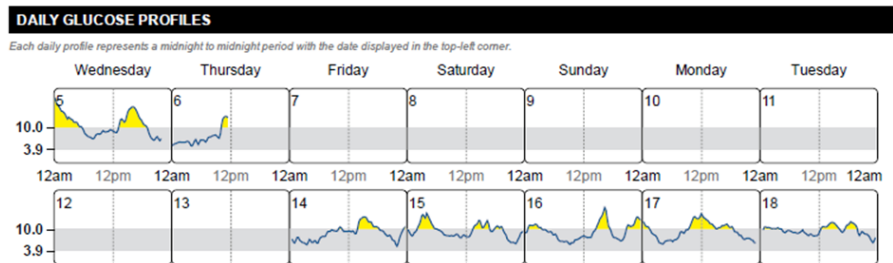


Figure 2: Daily glucose profiles of the first 2 weeks.

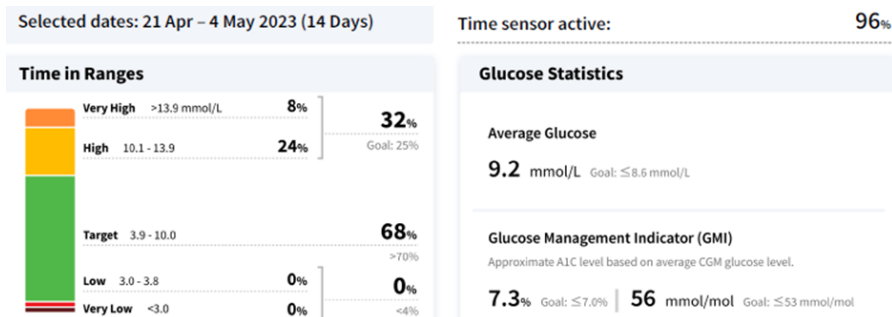


Figure 3: Glucose statistics and time in ranges of week 3 and 4.

May contacted her endocrinologist to review her insulin regimen as her BGLs was 34% within high range after the first 14 days trial (figure 1). The endocrinologist increased her Optisulin to 5 units pre-bed and set up the insulin to carbohydrate ratio for her main meals when using Novorapid. After using the sensor for another 14 days, her time in range within target was increased to 68% and time sensor active was improved to 96%; also, her BGLs within high range was reduced to 24% (figure 3).

Conclusion

Freestyle Libre sensor improved May's quality of life. She felt she has more control and empowerment for her diabetes management after using the sensor.

She felt better emotionally and safe because she did not have to stress about the unpredicted hypoglycaemia episodes. She found the alarm was very useful as it alerted her when her BGLs rising too high or if she was at risk of having hypoglycaemia.³

She found she has more freedom to socialise with people after using the sensor. She could enjoy her glass of wine at a birthday party or have a slice of pizza in a lunch meeting without worrying about her BGLs. She could easily scan the sensor and get the result.

The note function in the Libre View App is convenient for client to record the amount of carbohydrate intake and the insulin dose. It is useful for DNE and endocrinologist to review the data comprehensively.

References

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Case three

Yiting Scarlett Huang

Freestyle Libre 2 assists in glycaemic optimisation and adverse events reduction

Introduction

This case study presents the use of flash glucose meter (Freestyle Libre2) to prevent hypoglycaemic episodes for Mary* with type 2 diabetes mellitus (T2DM) on oral medications as well as insulin.

Mary was a 62-year-old female referred by her GP to the tertiary diabetes service for glycaemic management as well as chronic foot ulcer management. She had an extensive medical history, including macro- and microvascular complications. Current medical history includes:

- Bipolar disorder
- Eczema
- Chronic Kidney Disease (CKD) with macroalbuminuria
- Chronic back pain
- Bilateral Adrenal Adenoma
- Diabetic neuropathy
- Foot ulcer
- Gestational Diabetes Mellitus (GDM)
- Hypercholesterolaemia

- Ischaemic Heart Disease (IHD) with Coronary Artery Bypass Graft (CABG)
- Peripheral Vascular Disease (PVD) with stent in L) leg
- Type 2 Diabetes Mellitus (T2DM)

Current medications include:

- Metformin XR 500mg nocte
- Byetta 10mcg BD
- Novorapid 14 units TDS
- Optisulin 54 units nocte
- Bricanyl Turbuhaler 1 puffs BD
- Diazepam 2.5mg PRN
- Lipitor 40mg daily
- Lithium 50mg nocte, 25mg mane
- Mersyndol 450/9.75/5 x2 Nocte PRN
- Metoprolol Tartrate 50mg BD
- Symbicort

Social situation: lives with her partner at home and is unemployed.

Smoking: a current smoker but has reduced to four a day.

**Name was changed for confidential purposes.*

Assessment

Anthropometry: weight 79kg, height 154cm, BMI 37.6kg/M2

Pathology:

	25/10/2022
HbA1c (%)	7.1
Haemoglobin (g/L)	119
Fasting BGL (mmol/L)	7.6
eGFR (mL/min/1.73m2)	32
Albumin (g/L)	34
Fasting Cholesterol (mmol/L)	3.3
Triglycerides (mmol/L)	1.7
HDL (mmol/L)	1.0
LDL (mmol/L)	1.5

- Diabetes medication: Metformin XR 500mg daily, Trajenta 5mg daily, Byetta 10mcg BD, Novorapid 14 units TDS and Optisulin 54 units at night.
- Diet: breakfast: a bowl of cereal; a late morning snack: fruit; lunch, a sandwich or a few VitaWheats with vegemite or cheese; afternoon: another fruit; dinner: chicken and vegetables.

- Exercise: limited physical activities due to active foot ulcer, which requires reduced weight bearing.
- Other health professionals involved: regular podiatrist review due to chronic foot ulcer.

The initial rationale for using Freestyle Libre2:

- Mary was frustrated with how many times she needed to prick her fingers to obtain blood glucose levels (BGLs) as it started hurting them.
- The use of the Freestyle Libre2 sensor allows her to closely watch her BGLs, especially after treatment amendments.
- The data sharing function is convenient as Mary prefers to attend clinic appointments via telehealth.

Management

Flash glucose meter (FGM) was commenced at the first clinic appointment. Education about FGM was provided to Mary. Key features of the continuous glucose monitoring (CGM) device, including real-time glucose monitoring, alert system and data sharing function, were explained. Mary was advised to monitor her BGL via finger pricking if symptoms did not match the sensor glucose readings.

The following graph was a picture of Mary's Ambulatory Glucose Profile (AGP) during the second visit to the clinic.

AGP Report

8 January 2023 - 21 January 2023 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

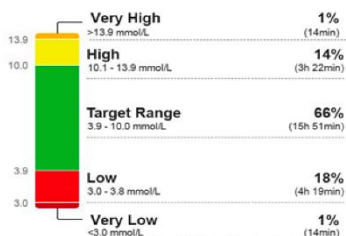
8 January 2023 - 21 January 2023 **14 Days**
% Time Sensor is Active **70%**

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% (56min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (9h)
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 **6.8 mmol/L**
Glucose Management Indicator (GMI) **6.2% or 45 mmol/mol**
Glucose Variability **42.9%**
Defined as percent coefficient of variation (%CV)

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.

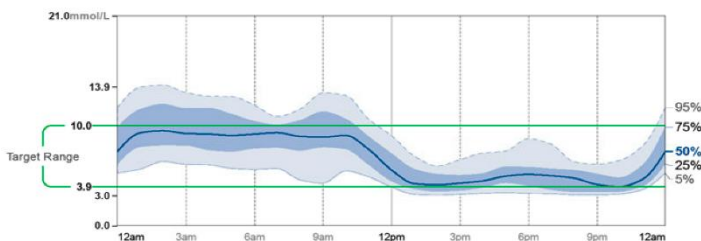


Figure 1: AGP report from 8 January 2023 to 21 January 2023.

At the second clinic appointment: Insulin doses were decreased by the endocrinologist to prevent further hypoglycaemic episodes.

Education was provided in terms of glucose trends and patterns, so Mary could understand the impact of various factors, such as diet and physical activity, on her BGLs.

Recommendations from the endocrinologist:

- Decrease Optisulin to 50 units nocte
- Decrease Novorapid to 12 unit pre breakfast, 6 unit pre lunch and 6 unit pre dinner

- Continue Byetta
- Cease Metformin
- Repeat eGFR, if result remains <30, will cease Byetta

The following graph shows Mary’s AGP at the third clinic appointment.

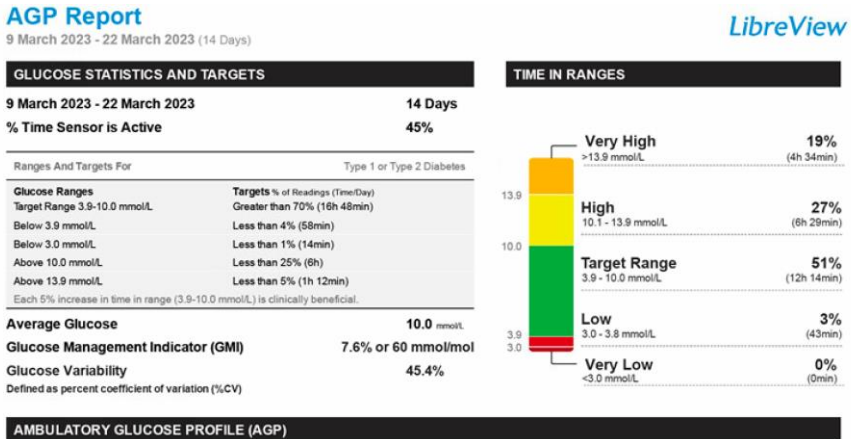


Figure 2: AGP report from 9 March 2023 to 22 March 2023.

As we can see from figure 2, the time of hypoglycaemia had drastically decreased after the endocrinologist changed her insulin regimen. Even though the percentage of hyperglycaemia had increased from 15% to 46%, both Mary and the endocrinologist were happy about the result. Mary said she started

having more understanding of how her BGLs respond to various factors. With the predictive arrow feature of the Libre2, she was able to make some sensible lifestyle adjustments accordingly.

Without the valuable aid from the Libre2, adverse events would have been missed. Additionally, the endocrinologist's ability to make appropriate clinical treatment adjustments would have been impeded.

Recommendations from the endocrinologist:

- Cease Byetta and commence Forxiga due to low eGFR
- Increase Optisulin to 52-unit nocte, if fasting blood glucose level are going high, increase the dose to 54 unit
- Decrease pre-lunch and pre-dinner Novorapid dose to 4 unit, Novorapid dose remains the same for breakfast

Additionally, Mary felt the device provided her with emotional security and physical safety as it sent alerts when her BGLs went low. She could go to sleep and knew that if any hypoglycaemia, the reader would wake her up. Mary said, 'the reader is more reliable than my partner in terms of that'.

She comprehended the significance of BGL monitoring, yet she endured considerable discomfort in her fingers owing to the repetitive needle punctures. Moreover, Mary preferred the discreet nature of Libre 2 that she didn't need to carry a traditional meter when going out. Mary said it did not draw any attention from people around her when she needed to know her blood sugar level in public.

This technology also enabled the remote appointment to provide further convenience to Mary who might not be physically available for appointments at times. This feature is of great importance to people with diabetes living with an active foot wound. As many are requested to reduce weight bearing activities to promote the wound healing by their podiatrists.

For healthcare professionals, the Libre 2 provides a clear overview of glycaemic excursions and comprehensive data analysis.

Conclusion

FGM as per Libre 2 provided many benefits to Mary. The technology enables her to monitor BGL in real-time, without intensive finger pricking. The system provides valuable insights into glucose trends and patterns, allowing Mary and healthcare professionals to make more informed decisions about her diabetes management. Finally, the Libre 2 improved her quality of life.

Case four

Sarah Le Lagadec

The use of Freestyle Libre 2 in people living with post-traumatic stress disorder

This case study discusses the benefits of utilising Freestyle Libre 2 for people living with Post Traumatic Stress Disorder (PTSD) who have an aversion to blood and are opposed to checking their blood glucose levels (BGLs) using traditional methods. The client involved is Bill*, an 86-year-old man with PTSD, early-stage dementia and type 2 diabetes. Bill is a Vietnam Veteran registered with the Department of Veteran Affairs (DVA). Bill's support network consists of his daughter with whom he does not have a good relationship, an inter-state niece who is his Power of Attorney and a good neighbour who offers him physical and mental support.

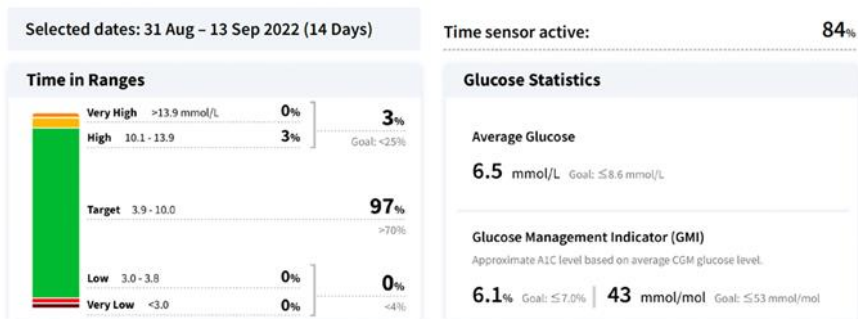
Although Bill lives with his daughter, it's Bill's neighbour who ensures that Bill takes his routine medications and attends health appointments. Bill's aversion to blood inhibits him from testing his BGLs, making him an ideal candidate to trial the Freestyle Libre 2. As a result of Bill's aversion to testing his BGLs, his General Practitioner (GP) only has his HBA1C to guide his diabetes treatment. Despite health education from his GP, Bill has not changed his BGL testing habits stating that he "spilt enough blood in Vietnam". Bill's niece reports that he maintains a healthy diet but cannot participate in structured exercise due to his decreased mobility.

Bill's diabetes is treated using the oral medication, Gliclazide and a healthy diet. Given Bill's PTSD and early-stage dementia, he does not test his BGLs. Without daily BGL reading, Bill's GP only has his HBA1C to guide his treatment. Multiple factors such as age, gender and body mass index can affect the HBA1C.¹ Also, the HBA1C doesn't indicate hypoglycemic events, therefore, relying exclusively on this measure is not a safe option.² Due to Bill's declining cognition, he is unable to appreciate the value of regular BGL monitoring and also, is unable to recognise and respond to BGLs that are outside of target range. In collaboration with Bill, his niece and his GP, it was agreed that an accurate record of Bill's BGLs was required to optimise his diabetes

management. Due to Bill's cognitive decline, the BGL monitoring method needed minimal effort on Bill's behalf. Freestyle Libre 2 was identified as a means of testing Bill's BGLs without having to fingerpick.³

After several discussions with his GP, Bill agreed to trial the Freestyle Libre 2. Since Bill is registered with the DVA, he has access to subsidised Freestyle Libre's should he wish to continue using this system. The GP's goal was to optimise Bill's BGLs by using measures other than HBA1C alone. A plan was developed, and executed, to trial the Freestyle Libre 2 over a two-week period with an informal telephonic review with the DE after the first week. At the end of the two-week trial Bill's BGLs were reviewed by the GP. At the start of the trial, Bill voiced his concern that he would forget to scan the Freestyle Libre 2 to check his BGL regularly. Since the Freestyle Libre 2 can retain eight hours worth of data³, Bill was encouraged to establish a routine of scanning each time he sat to eat his meals. During the week-one telephonic review, Bill and his niece reported his satisfaction with the technology and confirmed that he was regularly scanning his sensor. Using the Freestyle Libre 2 evoked Bill's curiosity regarding the pattern of his daily BGLs, which prompted him to scan his sensor more regularly. His niece reported that Bill had experienced no hypoglycaemic events that week.

During the two-week GP review, it was noted that 84% of data had been captured with 97% time in range. Both Bill and his GP were satisfied with the results and planned to continue using the Freestyle Libre 2. Furthermore, based on the BGL data captured, Bill's diabetes regimen was found to be optimal. During subsequent reviews, the DE noted that Bill's cognitive impairment hampered his ability to obtain a continued supply for the Freestyle Libre through DVA. He needed assistance with this. In the absence of his niece, the DE provided Bill with written instructions to facilitate ordering the product, which he did successfully. It would be advisable, as Bill's dementia progresses, that a supply of Freestyle Libre 2 be secured by Bill's support network or the DE.



Freestyle Libre 2 has improved Bill's quality of life by enabling his GP to safely monitor his BGLs and optimise his diabetes management. Using the Freestyle Libre 2, the GP now has more reliable data on which to base his treatment plan for Bill. Previously, Bill had an aversion to monitoring his BGLs. Now, he has developed a greater interest in his BGLs and is keen to monitor his progress. He also has peace of mind in the knowledge that his diabetes is well managed without having to "spill blood" through the traditional method of BGL monitoring. He has had no hypoglycaemic events since starting with this monitoring system. His support network also benefits since they have the reassurance that Bill's BGLs are generally within target range. Since it is known that veterans like Bill, have poorer health outcomes than non-veterans⁴, Bill is a good example of the efficacy of the Freestyle Libre 2 for veterans suffering from PTSD who are blood adverse.

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Case five

Shannon Lin, Annette Olson, Jemmima Jones, Mostafa Zaman, Brittney Finch, Jade Hansen & Wenbo Peng

Give it to me! It has brought my confidence and life back

Introduction

This case study presents a 60-year-old Indigenous man named ‘John’ living with Type 1 Diabetes (T1D)¹ with complex sociocultural and economic determinants of health²⁻⁴ (Table 1), which was critical in his diabetes care in a primary health care setting. It highlights how the use of a Continuous Glucose Monitoring System (CGMs) could improve John’s diabetes management by addressing his determinants of health.

Determinants	John’s circumstance
Health	Multiple chronic conditions: type 1 diabetes (T1D) since the age of 20; chronic kidney disease (CKD); diabetic retinopathy resulting in poor vision; coronary heart disease (CHD); and multiple seizures (caused by hypoglycaemic episodes).
Social	Geographically isolated in a remote area of New South Wales (NSW). Limited access to healthcare services. Lives alone. No family living nearby. Did not belong to any community group.

Social support	<p>No family support.</p> <p>Declined to any social event or join any community groups due to his anxiety resulting from the trauma.</p> <p>Received some support from National Disability Insurance Scheme (NDIS).</p>
Economic	<p>Lived in poverty as John was unemployed due to his complex medical conditions.</p> <p>Relied on Centrelink payment.</p>
Cultural beliefs and practices	<p>In 2015, his brother passed away while John was in the hospital for severe pneumonia. The traumatic experience resulted in increased anxiety about leaving home and meeting new people. Such experience contributed to his negative attitude towards hospitalisations and healthcare services. For example, he declined diabetes care from the multidisciplinary diabetes team (MDT) and only maintained minimal contact with the Aboriginal Medical Service (AMS).</p>
Health literacy	<p>Low health literacy because John never received formal education, resulted in very minimal literacy and numeracy skills. He could only write his name and could not read any text.</p>

Table 1: the sociocultural and economic determinants of health before John attended the Chronic Disease Clinic.

An urgent referral was made to the newly established Chronic Disease Clinic (CDC) in Sept 2022 with a multidisciplinary diabetes team (MDT) of a Practice Nurse (PN), Credentialed Diabetes Educator (CDE)/Advanced Accredited Practicing Dietitian (AdvAPD) (who provided monthly services), Aboriginal Health Workers (AHWs), and General Practitioners (GPs).

Assessment

The initial assessment was completed through a collective effort from the CDC and the review of his medical records at the AMS. The following issues were identified:

- Insulin administration time and injection techniques: on Glargine twice a day with a sliding scale of Aspart with poor injection techniques, while Aspart was administered at various times (Table 2 and Table 3).
- Irregular Self Blood Glucose Monitoring (SBGM): the blood glucose levels (BGLs) were checked intermittently using fingerpricks, not aware he was eligible for NDSS CGM subsidy.
- Erratic BGLs: the BGLs ranged from 2-20 mmol/L in Nov 2021 – Oct 2022.
- Frequent hypoglycaemia: hypoglycaemic episodes occurred 2-3 times a day, with severe hypoglycaemia every few weeks.
- Lifestyle: intentionally limited exercise to low-intensity walking, even though he used to play the NRL while maintaining a regimented diet due to his strong fear towards hypoglycaemia.
- Diabetes distress: high level of diabetes distress, mostly caused by his determinants of diabetes (Table 1) as per medical notes by the GP.
- Healthcare service access: basic medical management (e.g., scripts) with the Aboriginal Medical Service (AMS) and never sought further access to diabetes MDT support.
- NDIS support: only provided personal care assistance (e.g., shopping and housework) a few hours a week. No support to access any diabetes care.

	Glargine (Optisulin) per day	Insulin Aspart (Novorapid) per day
December 2022	10U* (4U morning and 6U night)	3-6U Inconsistent dose due to misunderstanding (John couldn't remember any education regarding injection techniques)
April 2023	3-4U morning only	3U before each meal
Improvement	6-7U with one less injection (average 6.5U)	~0-3U (average 1.5U) More consistent dose with improved understanding
Estimated cost saving ^{5,6} (Per day)	\$6.49 for Glargine and \$2.79 for Aspart Total: \$9.28 per day	
Estimated cost savings during the treatment ^{1,2}	\$973.65 for Glargine and \$421.56 for Aspart Total: 1,122.88 for 4 months (equivalent to 121 days)	

Table 2: The insulin dose changes and cost savings before and 4 months after the use of Freestyle Libre2. (U: the units of insulin.)

Injection techniques	December 2022	April 2023
Pens	The pens were expired or opened for more than >3 months.	<p>All pens were labelled and checked the expired dates by the CDE/AdvAPD.</p> <p>A reminder was set up to stick to his fridge for the disposal date of pens.</p>
Pen storage	All pens were stored in the kitchen.	<p>The unopened pens were stored in the fridge.</p> <p>The opened pens were in his room.</p>
Needles	The Size 8 needle was used, and the needle changed every couple of days.	The Size 4 needle was used and changed after each injection.
Needle disposal	Needles were left on the pen till the next needle change.	Needles were disposed of into the sharp container after each injection.

Table 3: Injection techniques records before and 4-month after the treatment.

Management

With the support of AHW, John was engaged with the CDC. A personalized diabetes management plan was developed with a priority of reducing severe hypoglycaemia⁷, while aiming to improve his confidence in diabetes self-management. The culturally appropriate strategies were considered⁸:

- The Freestyle Libre2 (CGM) was introduced at his first appointment by

the CDE/AdvAPD to reduce hypoglycaemic episodes through CGM without inconvenient fingerpicking. Libre2 was recommended due to its simplicity and ability to read aloud for poor vision with the proper mobile device and app. In addition, it allowed the MDT to access the real-time BGL to enable prompt adjustments of his insulin.⁹ John was excited by saying, 'Give it to me! I will have my confidence and life back. Just give it to me now!' The commencement of Libre2 was not smooth as the first barrier was the access to a compatible mobile alongside his poor literacy. The Libre Patient Start program provided John with a reader to allow time for the MDT to work with him to overcome the barriers. At the set-up with the CDE/AdvAPD, John decided to turn off the hyperglycaemia alarm to prevent alarm fatigue, which could help with his diabetes stress.

- All education was designed and tailored to his health literacy integrated with therapeutic and social yarning. The strength-based and storytelling techniques were applied to promote culturally appropriate and effective diabetes education:
 - plain language, analogues, metaphors and real-life examples for complex diabetes concepts;
 - visual aids for basic carbohydrate counting and pictorial resources;
 - the storytelling of the role model of NRL star, Steve Renouf with T1D, as John was a superfan;
 - the emphasis on hands-on practices like CGM and apps, injection techniques and carbohydrate counting;
 - Limited key information to three at a session to prevent information overload, while encouraging John to work on small changes one at a time (e.g., adjusting 1–2 things to reduce the BGL fluctuations).

As only four diabetes education sessions were provided to John (due to the monthly diabetes education clinic set-up), he was greatly supported by the MDT during that period.

- The holistic care was provided by the CDC to assist John with healthcare navigation¹⁰:
 - The NP was assigned as his primary who organized appointments, facilitated communication and liaised with external healthcare services. For example, the NP followed up with injection techniques after the diabetes education session to ensure his understanding;
 - The AHW had frequent contact with John to check his well-being and attended medical appointments with him;
 - John registered with the Integrated Team Care (ITC) programs for financial assistance (e.g., covering any specialist fees and a compatible mobile to use LibreLink app) and transport.

Although the Libre2 was used as a tool to implement person-centred care for four months with limited diabetes education sessions (4 sessions in total), the benefits to John's health outcomes and quality of life were evident, particularly, the reduced insulin dose and the number of injections with improved injection techniques, enhanced healthcare engagement, and the improved self-efficacy in diabetes management:

- Table 2 shows the reduction of insulin doses. Such an improvement was estimated to save \$9.28 per day (equivalent to \$1,122.88 for the 4-months he was on Libre2).
- Ambulatory Glucose Profile (AGP) reports from LibreView in Figure 1 (at the start of Libre2) and Figure 2 (at the 4-month of using Libre2) show Time in Range (TiR) and the Glucose Management Indicator (GMI) both improved by 6% and 0.5% respectively at 4-month (from 40% to 46%; 7% or 53 mmol/mol to 7.5% or 59 mmol/mol). The

increased GMI was favourable as it indicated less hypoglycaemia, especially the time recorded hypoglycaemia reduced from 20% (equivalent to 4 hours 48 min) to 15% (equivalent to 3 hours 6 min). The glucose variability also reduced from 69.3% to 62.6%.

- The real-time access to his AGP enabled the MDT for in-time dose adjustments. Alongside the improved injection techniques and correct injection time (Table 3), John experienced less glucose excursion and hypoglycaemic episodes, reducing his diabetes distress.
- John started with new exercises (e.g., resistance training) as he used the visualized CGM data to aid his making decisions to prevent hypoglycaemia. He said, "I am more confident, and my life is back".
- John developed a relationship with the CDC, as evidenced by figure 3. He didn't engage in his urgent medical needs but also for preventive health (e.g., the completion of Health Check 715 and GP Management Plan 721/723 with up-to-date immunisations).

AGP Report

12 December 2022 - 25 December 2022 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

12 December 2022 - 25 December 2022 **14 Days**
% Time Sensor is Active **40%**

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)

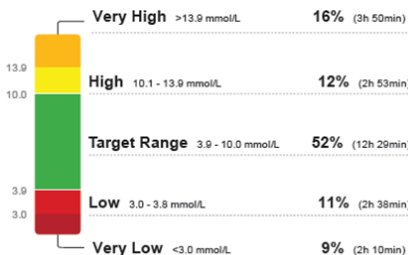
Average Glucose **8.6 mmol/L**
 Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Glucose Management Indicator (GMI) **7.0% or 53 mmol/mol**

Glucose Variability **69.3%**

Defined as percent coefficient of variation (%CV)

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.

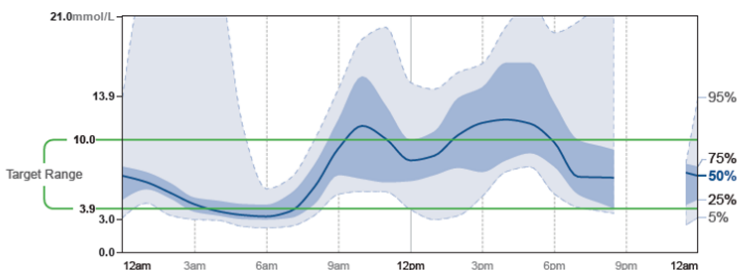


Figure 1: AGP report after John commenced on Libre2 in 2022.

AGP Report

14 April 2023 - 27 April 2023 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

14 April 2023 - 27 April 2023 **14 Days**
 Time Sensor Active: **82%**

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% (10h 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 **62.6%**
 Defined as percent coefficient of variation (%CV)

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.

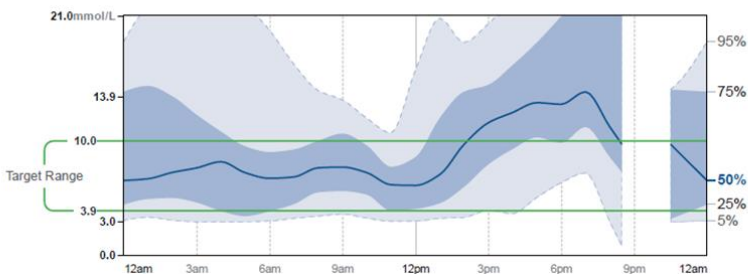


Figure 2: AGP report after John used Libre2 for 4-month in 2023.



Figure 3: John's healthcare engagement since enrolled with the Chronic Disease Clinic (CDC) from Sept 2022 to March 2023.

Conclusion

Indigenous people with diabetes often face additional but significant challenges from sociocultural and economic determinants of health. The key contributor to the success, in this case, is the MDT, which emphasises on holistic, visual and collaborative approach guided by culturally appropriate communication, person-centred care and health literacy principles. The CGM was a valuable tool to facilitate the implementation of person-centred diabetes education and enable John and his healthcare team for decision-making. Therefore, John started to take charge of his T1D while benefiting from improved glycaemia (i.e., less hypoglycaemia), fewer diabetes medications and diabetes distress as facilitated by the culturally appropriate and responsive diabetes care at the primary healthcare setting.

We acknowledged that the main weaknesses of the case study were the short duration with limited access to diabetes education, while the glycaemic management was yet to be optimized. In future, more work is still needed (e.g., adjustments to his breakfast insulin and/or excessive carbohydrates at lunch are needed for the identified 'low' BGL pattern at lunch, as shown in figure 2, and continuous education and support are needed to reinforce his understanding and interpretation about the CGM data to increase his self-efficacy in managing diabetes). Nonetheless, the learning from this case study

can be summarised by John's words: "Give it to me!" and "I am more confident, and my life is back".

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Case six

Belinda Moore

Using flash glucose monitoring to reengage, rebuild and relearn

Aunty is a 64-year-old Aboriginal woman who does not attend healthcare appointments. In fact, Aunty does not leave home at all. Aunty cannot tolerate to weight bare nor ambulate secondary to severe peripheral neuropathy.

Aunty weighs 48 kg. Aunty has an adequate appetite although does snack on high GI foods throughout evenings and overnight to cope with disrupted sleep secondary to severe pain. Aunty is fatigued during the day. The pain, lack of sleep, overnight snacking and stress is impacting her glycaemic profile.

Aunty lives with her 44-year-old adult child who is her fulltime carer. Her carer does not work and has limited social opportunities. Both Aunty and her family do not want to move her into care away from home. Aunty has type 2 Diabetes and uses Freestyle Libre 2 sensors with a reader, so she does not have to finger prick.

Aunty nor her carer do anything with sensor glucose levels seen upon scanning. Aunty's case worker contacted me as the CDE working at Aunty's local Aboriginal Cooperative asking for assistance with troubleshooting sensor related issues. Every sensor was stopping on day 7.

Assessment

Medical history

Condition	Diagnosed
Type 2 diabetes (T2DM)	2003
Hypertension	2022

Cataract (left eye)	Unknown
Blindness (left eye)	2011
Chronic pancreatitis	2003
Fatty liver disease	2003
Diverticulitis disease	2008
Benign hepatic haemangioma	2009
Chronic kidney disease (stage 3)	2012
C2/3 severe facet joint degeneration	2015
C5/6 osteophyte	2015
Peripheral neuropathy	2020
Macroalbuminuria	2021
Bilateral proximal tibia and fibula fractures	2022
Rare genetic skin condition affecting hands and feet	Unknown

Medications

Drug name	Dose	Frequency	Indication
Ryzodeg	30 units	Twice daily	T2DM
Gliclazide	60 mg	Once daily	T2DM
Metformin	1000 mg	Night time	T2DM

Glucagon hypokit	1 mg	As required	Severe hypoglycaemia
Dirprosone ointment	0.05%	Twice daily	Skin condition
Esomeprazole	20 mg	Once daily	Reflux
Ferrous fumarate	200 mg	Once daily	Fluctuating iron levels
Lercanidipine	10 mg	Morning time	Hypertension
Creon	25000 units	1 tablet with light meals 2 tablets with main meal	Complex hepatic history
Metoprolol	25 mg	Twice daily	Hypertension
Moxonidine	200 mcg	Night time	Hypertension
Rosuvastatin	20 mg	Once daily	Heart disease preventative
Thiamine	100 mg	Morning time	Mineral deficiency
Pregabalin	300 mg	Night time	Pain management
Cholecalciferol	25 mcg	Once daily	Osteoporosis management
Magnesium	500 mg	2 tablets twice daily	Mineral deficiency
Mirtazapine	30 mg	2 tablets night time	Depression

Sodium bicarbonate	840 mg	Three times a day	Reflux
Amitriptyline	50 mg	Night time	Depression

Management

Aunty was initially managed on Optinsulin 15 units at night. All her oral medications including gliclazide and metformin continue.

Aunty was experiencing persistent hyperglycaemia. Aunty's glucose levels were 'HI'. The only way Aunty's carer knew how to manage this was to give 10–20-unit boluses of Optinsulin at the time of seeing individual 'HI' readings. The carer had minimal insight on how to administer insulin with purpose.

The only pathology results available were from February 2022. When I downloaded the Libre 2 reader for the first time, the only data I could see was the AGP that showed an estimated A1C of 18.1% and an average sensor glucose of 26.2 mmol. I could not see other data on the weekly summaries or daily logs because her glucose levels were so high, they were off the trace. Aunty does not access blood glucose or ketone strips as she is adamant, she will not finger prick.

At the first home visit, the purpose of the AGP was explained to Aunty and the carer highlighting what we look for when we assess glycaemic profiles and what personalised SMART goals we can make based on the data.

Snapshot

10 December 2022 - 3 March 2023 (84 days)

 Glucose

Estimated A1c **18.1%** or **174 mmol/mol**

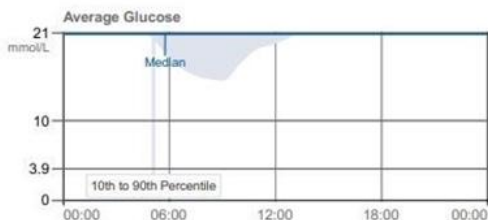
AVERAGE GLUCOSE

26.2 mmol/L

% above target **99** %

% in target **1** %

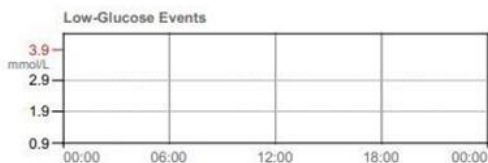
% below target **0** %



LOW-GLUCOSE EVENTS

0

Average duration **0** Min



Sensor Usage

SENSOR DATA CAPTURED

59 %

Daily scans **3**



Monthly Summary

January 2023



	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Average Glucose							High 27.8 mmol/L
Scans/Day							1
Low-Glucose Events							
	2	3	4	5	6	7	8
		High 27.8 mmol/L 3	High 27.8 mmol/L 1	High 27.8 mmol/L 2	High 26.5 mmol/L 5	High 27.8 mmol/L 1	High 27.0 mmol/L 5
	9	10	11	12	13	14	15
	High 27.8 mmol/L 5	High 18.0 mmol/L 6	High 27.8 mmol/L 3	High 27.8 mmol/L 2	High 27.3 mmol/L 4	High 27.8 mmol/L 4	High 27.8 mmol/L 2
	16	17	18	19	20	21	22
	High 25.2 mmol/L 3		High 27.8 mmol/L 1	High 22.5 mmol/L 2		High 16.5 mmol/L 2	High 23.1 mmol/L 4
	23	24	25	26	27	28	29
	High 26.9 mmol/L 4	High 27.8 mmol/L 2	High 27.6 mmol/L 5	High 27.8 mmol/L 2	High 22.2 mmol/L 2	High 26.4 mmol/L 2	High 25.3 mmol/L 1
	30	31					
	High 26.2 mmol/L 4	High 27.8 mmol/L 4					

Monthly Summary

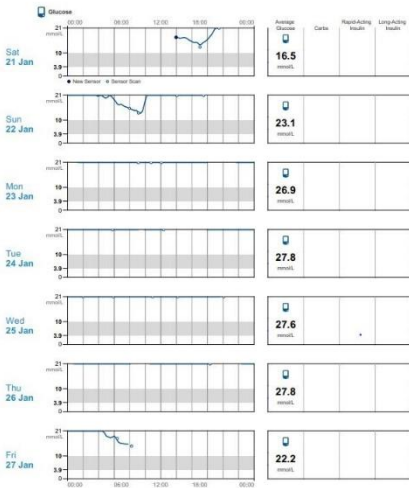
February 2023



	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Average Glucose			High 27.8 mmol/L	High 25.9 mmol/L	High 27.8 mmol/L	High 26.2 mmol/L	High 20.3 mmol/L
Scans/Day			3	3	2	3	7
Low-Glucose Events							
			High 27.7 mmol/L	High 25.8 mmol/L		High 27.8 mmol/L	High 27.8 mmol/L
	High 26.4 mmol/L 7	High 27.2 mmol/L 3	High 27.7 mmol/L 3	High 25.8 mmol/L 6		High 27.8 mmol/L 2	High 27.8 mmol/L 3
	High 27.1 mmol/L 3		High 27.8 mmol/L 2	High 27.5 mmol/L 10	High 27.8 mmol/L 3	High 27.4 mmol/L 2	High 27.8 mmol/L 7
		High 27.8 mmol/L 5	High 27.8 mmol/L 2	High 26.7 mmol/L 6	High 27.8 mmol/L 3	High 27.8 mmol/L 5	High 27.4 mmol/L 5
	High 27.7 mmol/L 3	High 27.8 mmol/L 7					

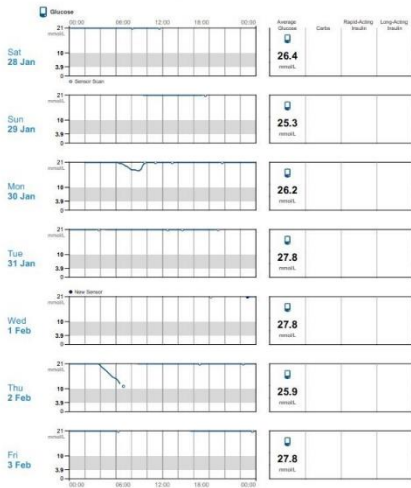
Weekly Summary

10 December 2022 - 3 March 2023 (84 days)



Weekly Summary

10 December 2022 - 3 March 2023 (84 days)



Daily Log

10 December 2022 - 3 March 2023 (84 days)



Daily Log

10 December 2022 - 3 March 2023 (84 days)



Aunty's perspective on own health and wellbeing

SMART goals at home visit on 3/3/23:

- Reduce the severity of pain in her feet and legs.

Carer's perspective on Aunty's health and wellbeing

SMART Goals at home visit on 3/3/23:

- Solve the problem of why the sensor would not last past 7 days.

CDE's perspective on Aunty and Carer's health and wellbeing

SMART Goals at home visit on 3/3/23:

- Take bloods to review HbA1C, FBE, UEC, LFT and Lipids.
- Check blood pressure.
- Change insulin type to twice daily Ryzodeg.
- Assess condition of the feet.
- Observe sensor insertion technique.
- Encourage Aunty and carer to use mobile phone so I could support them remotely.
- Continue to build rapport with Aunty and the carer so I can deliver personalised diabetes education to optimise self-management knowledge and skills.

Aunty, Carer and CDE's collaborative plan

SMART goals at home visit on 3/3/23:

- Contact Abbott to discuss why sensors and readers shut off as insertion technique is correct. Hypothesis is excessive glucose saturation causes issues with enzymes around sensors resulting in algorithms in reader to shut off.
- Arrange Endocrinologist to conduct phone review.
- Discuss with podiatry services options for managing the rare genetic skin condition affecting the feet and the severe peripheral neuropathy.

CUMULATIVE REPORT

Laboratory:	SHE	SHE		
Date:	28-Feb-22	03-Mar-23		
Time:	12:05	12:50		
Episode No.:	13174593	14627643		
Spec. Type:	BLOOD	BLOOD	Units	Ref. Interval
Fasting	no	no		
Thyroid Studies				
TSH	3.48	--	mIU/L	(0.27 - 4.20)
General Endocrinology				
HbA1c (IFCC)	174	197	mmol/mol	
HbA1c (DCCT)	18.1	20.2	%	

CUMULATIVE REPORT

Date:	28-Feb-22	03-Mar-23		
Time:	12:05	12:50		
Episode No.:	13174593	14627643	Units	Ref. Interval
Full Blood Count				
Haemoglobin	117	110 L	g/L	(115 - 155)
White Cell Count	9.1	6.5	$\times 10^9/L$	(4.0 - 12.0)
Platelet Count	283	144 L	$\times 10^9/L$	(150 - 400)
MCV	87	90	fL	(80 - 99)
RCC	4.04	3.67	$\times 10^{12}/L$	(3.60 - 5.20)
Hct	0.35	0.33	L/L	(0.33 - 0.45)
MCH	29.0	30.1	pg	(26.0 - 34.0)
MCHC	336	334	g/L	(315 - 365)
RDW	14.6 H	13.8	%	(11.6 - 14.0)
White Cell Differential				
Neutrophils	6.8	4.0	$\times 10^9/L$	(2.0 - 8.0)
Lymphocytes	1.9	2.1	$\times 10^9/L$	(1.0 - 3.5)
Monocytes	0.3	0.3	$\times 10^9/L$	(0.2 - 1.0)
Eosinophils	0.1	0.1	$\times 10^9/L$	(0.0 - 0.5)
Basophils	0.0	0.0	$\times 10^9/L$	(0.0 - 0.2)

CUMULATIVE REPORT

Laboratory:	SHE	SHE	SHE		
Date:	28-Feb-22	01-Mar-22	03-Mar-23	Units	Ref. Interval
Time:	12:05	11:10	12:50		
Episode No.:	13174593	13179459	14627643		
Spec. Type:	BLOOD	BLOOD	BLOOD		
General Chemistry (Serum/Plasma)					
Sodium	133 L	133 L	125 L	mmol/L	(135 - 145)
Potassium	6.0 H	5.1	4.4	mmol/L	(3.5 - 5.2)
Chloride	94 L	94 L	88 L	mmol/L	(95 - 110)
Bicarbonate	21 L	23	23	mmol/L	(22 - 32)
Urea	12.4 H	14.3 H	18.8 H	mmol/L	(3.3 - 7.6)
Creatinine	130 H	117 H	141 H	umol/L	(44 - 80)
eGFR	38 L	43 L	34 L	See Below	(> 90)
Calcium	2.36	--	--	mmol/L	(2.10 - 2.60)
Calcium Corrected	2.44	--	--	mmol/L	(2.10 - 2.60)
Magnesium	0.68 L	--	--	mmol/L	(0.70 - 1.10)
Phosphate	1.22	--	--	mmol/L	(0.75 - 1.50)
Total Protein	65	--	63	g/L	(60 - 80)
Albumin	36	--	33 L	g/L	(34 - 48)
Globulin	29	--	30	g/L	(25 - 40)
Bilirubin	3	--	2	umol/L	(< 17)
ALT	109 H	--	296 H	U/L	(< 5 - 31)
AST	H	--	158 H	U/L	(< 5 - 31)
GGT	362 H	--	312 H	U/L	(6 - 42)
ALP	281 H	--	326 H	U/L	(30 - 110)
Lipid Studies (Serum/Plasma)					
Cholesterol	2.2	--	1.9	mmol/L	(< 4.0)
Triglycerides	2.0 H	--	1.5	mmol/L	(< 2.0)
HDLc	1.4	--	1.1	mmol/L	(> 1.0)
LDLc	< 0.1	--	0.1	mmol/L	(< 2.5)
Non-HDL Chol	0.8	--	0.8	mmol/L	(< 2.5)
Chol:HDL	1.5	--	1.7		
Fasting	no	--	no		

Snapshot

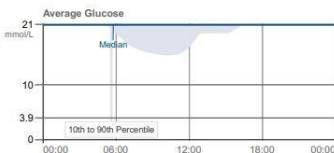
30 March 2023 - 20 April 2023 (22 days)



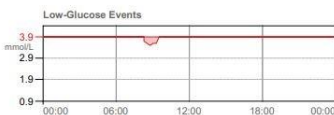
Glucose

Estimated A1c **17.6%** or **169 mmol/mol**

AVERAGE GLUCOSE	25.4 mmol/L
% above target	99 %
% in target	1 %
% below target	0 %



LOW-GLUCOSE EVENTS	1
Average duration	90 Min



Sensor Usage

SENSOR DATA CAPTURED	90 %
Daily scans	6



Logged Carbs

DAILY CARBS grams/day

Logged Insulin

Rapid-Acting Insulin units/day

Long-Acting Insulin units/day

TOTAL DAILY INSULIN units/day

Snapshot

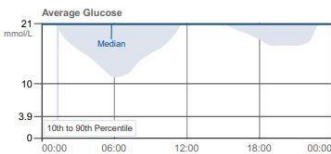
20 April 2023 - 5 May 2023 (16 days)



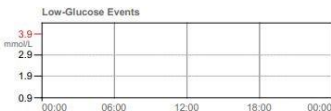
Glucose

Estimated A1c **17.3%** or **166 mmol/mol**

AVERAGE GLUCOSE	24.9 mmol/L
% above target	99 %
% in target	1 %
% below target	0 %

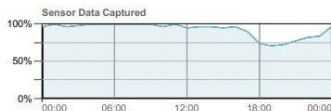


LOW-GLUCOSE EVENTS	0
Average duration	0 min



Sensor Usage

SENSOR DATA CAPTURED	93 %
Daily scans	7



Logged Carbs

DAILY CARBS _____ grams/day

Logged Insulin

Rapid-Acting Insulin _____ units/day

Long-Acting Insulin _____ units/day

TOTAL DAILY INSULIN _____ units/day

Monthly Summary

March 2023



	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Average Glucose			1	2	3	4	5
Scans/Day							
Low-Glucose Events							
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
					High 27.8 mmol/L 0	High 27.5 mmol/L 9	High 27.8 mmol/L 7
	High 23.7 mmol/L 9	High 27.8 mmol/L 5	High 27.8 mmol/L 4	High 27.8 mmol/L 8	High 26.9 mmol/L 7	High 24.4 mmol/L 8	High 24.5 mmol/L 3
	High 24.4 mmol/L 4	High 27.8 mmol/L 4					

Monthly Summary

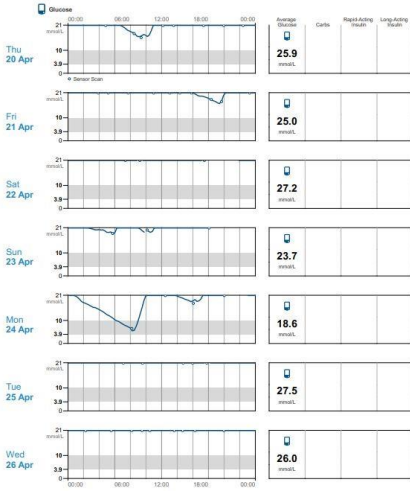
April 2023



	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Average Glucose						High 26.7 mmol/L	High 27.8 mmol/L
Scans/Day						10	6
Low-Glucose Events							
	High 25.1 mmol/L 3	High 27.5 mmol/L 4	High 27.8 mmol/L 14	High 25.6 mmol/L 6	High 19.7 mmol/L 7	High 24.3 mmol/L 5	High 26.7 mmol/L 3
	High 27.8 mmol/L 6	High 26.2 mmol/L 8	High 23.9 mmol/L 3	High 27.1 mmol/L 4	High 22.3 mmol/L 8	High 26.6 mmol/L 7	High 25.4 mmol/L 6
	High 27.4 mmol/L 5	High 17.6 mmol/L 8	High 24.1 mmol/L 5	High 25.9 mmol/L 8	High 25.0 mmol/L 10	High 27.2 mmol/L 3	High 23.7 mmol/L 3
	High 18.6 mmol/L 4	High 27.5 mmol/L 5	High 26.0 mmol/L 9	High 27.1 mmol/L 5	High 27.2 mmol/L 6	High 23.3 mmol/L 6	High 24.3 mmol/L 14

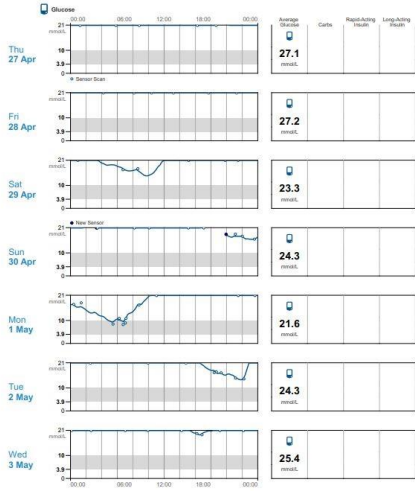
Weekly Summary

20 April 2023 - 5 May 2023 (16 days)



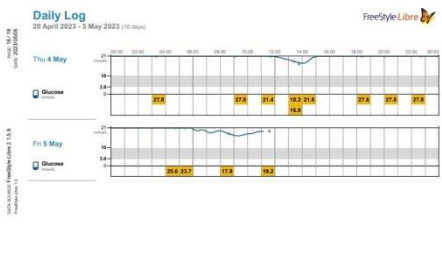
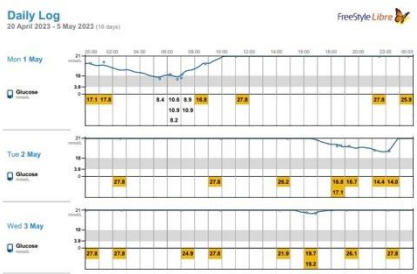
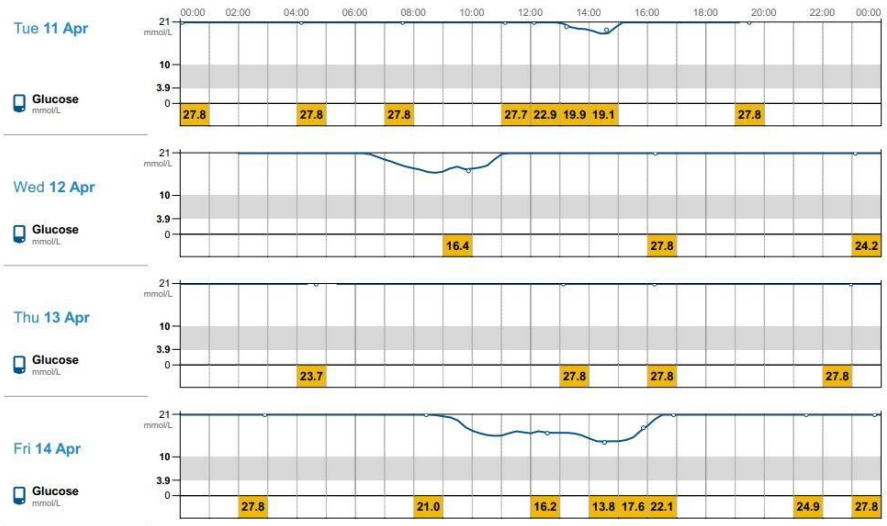
Weekly Summary

20 April 2023 - 5 May 2023 (16 days)



Daily Log

30 March 2023 - 20 April 2023 (22 days)



Aunty's perspective on own health and wellbeing

Outcomes at home visit on 12/5/23:

- Aunty consented to receiving GP phone review.
- Aunty requested phone review with nephrologist.

- Aunty consented to ongoing home visits from physiotherapist.

Carer's perspective on Aunty's health and wellbeing

Outcomes at home visit on 12/5/23:

- The carer is so motivated because sensors last full 14 days.
- The carer is relieved they are seeing actual numbers not 'HIs'.
- The carer's diabetes-related knowledge has positively advanced from discussions about Aunty's Libreview data. They understand key concepts:
 - Eliminating extreme insulin boluses prevents significant hypoglycaemia.
 - Reducing glucose variability percentage minimises risk of diabetes-related complications.
- The carer's nutrition knowledge is increasing from our weekly discussions:
 - Initially the carer believed that Aunty should eat KFC and apple pie with ice-cream because high fat foods would increase Aunty's weight.
 - Now the carer cooks a variety of omelettes as they understand the role of protein in optimising weight.
 - It has been observed that the carer is at high risk of experiencing carer's burnout.

CDE's perspective on Aunty and Carer's health and wellbeing

Outcomes at home visit on 12/5/23:

- Venous HbA1C decreased 3% from 20.2% to 17.2% in 3 months.
- LFTs improving.
- eGFR stable.
- Lipid profile within target range.
- Blood pressure remains normotensive.

Aunty, Carer and CDE's collaborative plan

Revised SMART goals at home visit on 12/5/23:

- Optimise pain management.
- Arrange respite for carer.

- Continue with weekly personalised diabetes education, sensor download reviews and insulin adjustments to achieve:
- TIR up to 25% and HbA1C <15% by August 2023
- TIR up to 50% and HbA1C <10% by November 2023
- Continue with home visiting physiotherapist.
- Compression stockings to be bought for DVT prophylaxis secondary to immobility, but also to reduce lower limb discomfort.

Snapshot

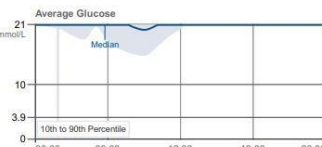
5 May 2023 - 12 May 2023 (8 days)



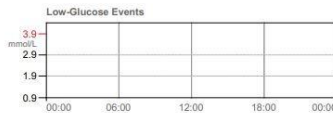
Glucose

Estimated A1c **17.5% or 168 mmol/mol**

AVERAGE GLUCOSE	25.2 mmol/L
% above target	100 %
% in target	0 %
% below target	0 %



LOW-GLUCOSE EVENTS	0
Average duration	0 Min



Sensor Usage

SENSOR DATA CAPTURED	87 %
Daily scans	7



Logged Carbs

DAILY CARBS _____ grams/day

Logged Insulin

Rapid-Acting Insulin _____ units/day

Long-Acting Insulin _____ units/day

TOTAL DAILY INSULIN _____ units/day

Monthly Summary

May 2023

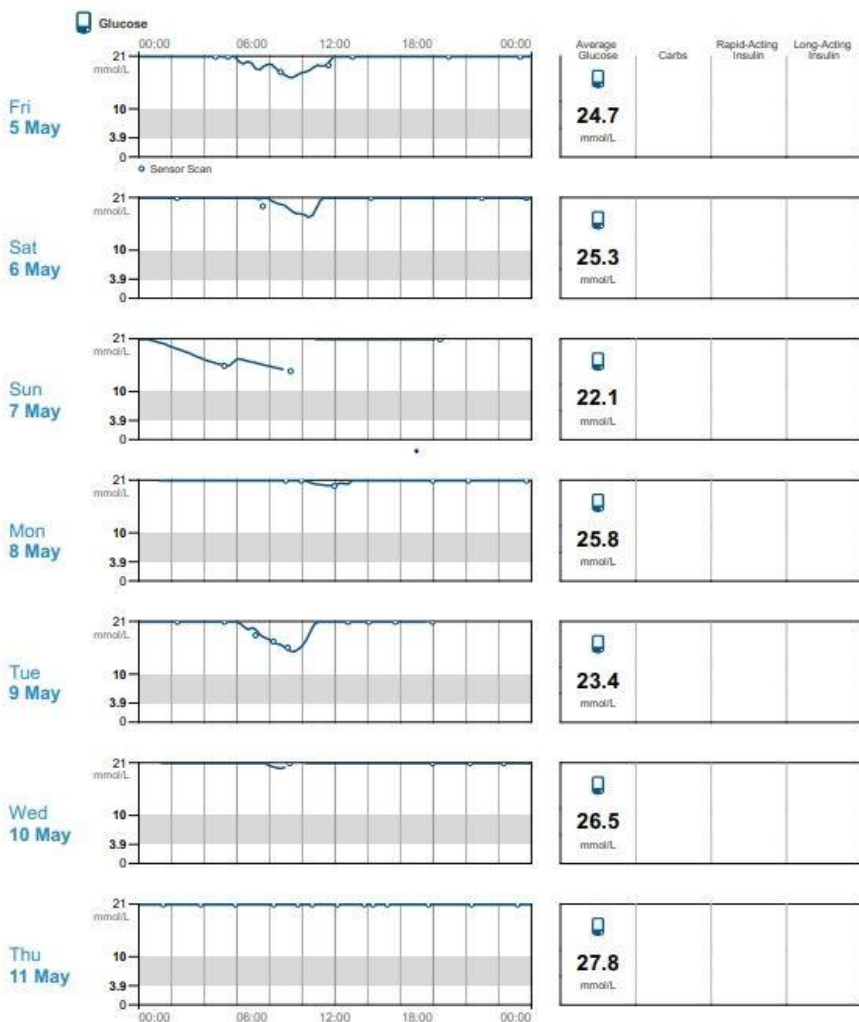


	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Average Glucose	High 21.6 mmol/L	High 24.3 mmol/L	High 25.4 mmol/L	High 26.2 mmol/L	High 24.7 mmol/L	High 25.3 mmol/L	High 22.1 mmol/L
Scans/Day	13	8	9	9	7	4	3
Low-Glucose Events							
	8	9	10	11	12	13	14
	High 25.8 mmol/L 6	High 23.4 mmol/L 9	High 26.5 mmol/L 4	High 27.8 mmol/L 13	High 24.8 mmol/L 7		
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31				

Weekly Summary

5 May 2023 - 12 May 2023 (8 days)

FreeStyle Libre 



Daily Log

5 May 2023 - 12 May 2023 (8 days)



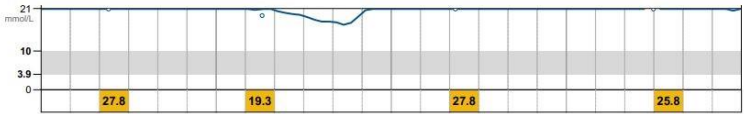
Fri 5 May

Glucose



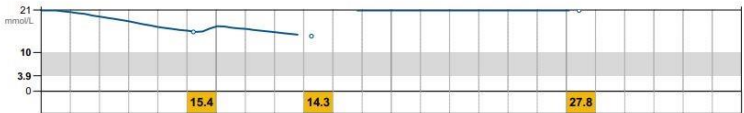
Sat 6 May

Glucose



Sun 7 May

Glucose



Mon 8 May

Glucose



CUMULATIVE REPORT

Laboratory:

Date:

Time:

Episode No.:

Spec. Type:

SHE

28-Feb-22

12:05

13174593

BLOOD

SHE

03-Mar-23

12:50

14627643

BLOOD

SHE

12-May-23

15:52

14910448

BLOOD

Units

Ref. Interval

Fasting

no

no

no

Thyroid Studies

TSH

3.48

--

--

mU/L

(0.27 - 4.20)

General Endocrinology

HbA1c (IFCC)

174

197

165

mmol/mol

HbA1c (DCCT)

18.1

20.2

17.2

%

CUMULATIVE REPORT

Date:	28-Feb-22	03-Mar-23	12-May-23		
Time:	12:05	12:50	15:52		
Episode No.:	13174593	14627643	14910448	Units	Ref. Interval

Full Blood Count

Haemoglobin	117	110 L	106 L	g/L	(115 - 155)
White Cell Count	9.1	6.5	8.6	$\times 10^9/L$	(4.0 - 12.0)
Platelet Count	283	144 L	191	$\times 10^9/L$	(150 - 400)
MCV	87	90	89	fL	(80 - 99)
RCC	4.04	3.67	3.63	$\times 10^{12}/L$	(3.60 - 5.20)
Hct	0.35	0.33	0.32 L	L/L	(0.33 - 0.45)
MCH	29.0	30.1	29.1	pg	(26.0 - 34.0)
MCHC	336	334	328	g/L	(315 - 365)
RDW	14.6 H	13.8	14.5 H	%	(11.6 - 14.0)

White Cell Differential

Neutrophils	6.8	4.0	6.4	$\times 10^9/L$	(2.0 - 8.0)
Lymphocytes	1.9	2.1	1.7	$\times 10^9/L$	(1.0 - 3.5)
Monocytes	0.3	0.3	0.4	$\times 10^9/L$	(0.2 - 1.0)
Eosinophils	0.1	0.1	0.1	$\times 10^9/L$	(0.0 - 0.5)
Basophils	0.0	0.0	0.0	$\times 10^9/L$	(0.0 - 0.2)

Conclusion

The most rewarding thing is seeing how the weekly phone reviews are reengaging Aunty and her carer into the health and wellbeing services at the Aboriginal Cooperative; rebuilding the carer's diabetes-related knowledge around what the AGP data tells us so we can safely adjust insulin to optimise short- and long-term diabetes outcomes; and relearning how to make lifestyle changes to optimise Aunty's glycaemic profile.

References

1. Alva S, Bailey T, Brazg R, Budiman ES, Castorino K, Christiansen MP, et al. Accuracy of a 14-day factory-calibrated continuous glucose monitoring system with advanced algorithm in pediatric and adult population with diabetes. *Journal of Diabetes Science and Technology* [Internet]. 2020 Sep 19;16(1):70–7. Available from: <https://journals.sagepub.com/doi/epub/10.1177/1932296820958754>
2. Kovatchev B. Glycemic variability: risk factors, assessment, and control. *Journal of Diabetes Science and Technology* [Internet]. 2019 Jul 29;13(4):627–35. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6610616/>
3. Lee SK, Shin DH, Kim YH, Lee KS. Effect of diabetes education through pattern management on self-care and self-efficacy in patients with type 2 diabetes. *International Journal of Environmental Research and Public Health* [Internet]. 2019 Sep 9;16(18):3323. Available from: <https://www.mdpi.com/1660-4601/16/18/3323>
4. Lin R, Brown F, Ekinçi EI. The ambulatory glucose profile and its interpretation. *Medical Journal of Australia* [Internet]. 2022 Aug 7;217(6):295–8. Available from: https://www.mja.com.au/system/files/issues/217_06/mja251666.pdf
5. Polonsky WH, Fisher L. When does personalized feedback make a difference? A narrative review of recent findings and their implications for promoting better diabetes self-care. *Current Diabetes Reports* [Internet]. 2015 Aug 1;15(8):50. Available from: https://click.endnote.com/viewer?doi=10.1007%2Fs11892-015-0620-7&token=WzM5NTk1ODk5LjEwLjEwMDcvczExODkyLTAxNS0wNjIwLTciXQ.N75PLgvd4UzC9mDA0pC_GH9vBU

6. Taylor PJ, Thompson CH, Brinkworth GD. Effectiveness and acceptability of continuous glucose monitoring for type 2 diabetes management: a narrative review. *Journal of Diabetes Investigation* [Internet]. 2018;9(4):713–25. Available from: <https://click.endnote.com/viewer?doi=10.1111%2Fjdi.12807&token=WzM5NTk1ODkxIjEwLjExMTEvamRlEYODA3Ii0.rlykHV06YHKKoRntOggSZxZaMA>

Case seven

Rachel McKeown

FreeStyle Libre to improve sock styling – a motivating tool for wound management

Sixty-year-old Mr E was referred to the diabetes education service via the hospital's wound clinic with the support of Mr E's general practitioner (GP). He has type 2 diabetes requiring insulin and is prescribed Novomix 30/70 BD. At the time of referral, Mr Es doses were 40 units mane and 32 units nocte.

Mr E had a chronic leg ulcer and was not regularly monitoring his blood glucose levels (BGLs). His glycated haemoglobin (HbA1c) at the time of referral was 7.1%, however Mr Es GP was concerned due to the long-standing wound with poor healing, and the few BGLs Mr E did check were either very high (up to 20mmol/L) or very low (3mmol/L).

Mr E has mild impaired cognition and lives on his own, with support from Department of Veterans Affairs (DVA). He attends wound clinic three times/week and has a good relationship with the nurses.

The GP also noted in her referral, which was reiterated at the time of initial assessment by the wound clinic nurses, her concern regarding Mr Es dietary intake, low health literacy, low cooking skills and their potential effect on hyperglycaemia and wound healing.

Ultimately, Mr Es GP was referring for diabetes education to assist with overall diabetes management, education and support, closer blood glucose monitoring and advice regarding dose adjustment of insulin.

Assessment

At our first meeting, with Mr E wearing his Parramatta Eels supporter beanie and one footy sock, he was quick to tell me his goal was to be able to wear his matching pair, ready for the next grand final!

Mr E explained he was monitoring his BGLs twice per day with a glucometer but would sometimes forget. He reported hypoglycaemia events every 2-3 days, which he would treat with jellybeans, acknowledging that he knew not to have too many.

Current physical activity levels were limited due to his leg ulcer pain, although previously he enjoyed walking and bike riding. His mode of transport is a scooter.

Mr E's diet consists of: Nutrigrain or Special K with milk for breakfast, lunch at either a café or the local RSL club where he would usually have chicken schnitzel or burger, salad and chips. His dinner was an easier meal of toast, noodles or pasta. He reported fruit for snacks if he was hungry and drank water. Following consultation previously with the dietitian, Mr E was also drinking two Arginaid supplements per day for wound healing benefits.

Mr Es weight was 103kg, with body mass index 35.

Upon discussion regarding a two-week trial of a flash glucose monitor, Mr E was keen to try the Libre 2 sensor to assist in potentially detecting hyper- and hypoglycaemia before occurring and to learn more about how foods affect his glucose levels.

Management

With FGM initiated, follow up occurred every 3 days in wound clinic with support of the wound clinic nurses who were also very interested in the technology they hadn't seen before.

Diabetes education and support was provided regarding healthy diet for diabetes management and wound healing, ensuring correct injection technique of insulin, weight management to improve glycaemia and discussion of appropriate glucose level targets for wound healing. Advice regarding appropriate glucose targets was to ensure glucose levels were not too low, avoiding hypoglycaemia, or extremely high. Research has shown that a level of HbA1c that ranges from 7.0% to 8.0% during wound healing treatment would be more helpful in people with diabetic foot ulcer (DFU) than other levels¹.

For clients with baseline HbA1c < 7.0%, elevated HbA1c during management is associated with accelerated wound healing, indicating that a slightly higher glycaemic level is better for wound healing in DFU patients². I therefore focussed on reducing hypoglycaemia with Mr E with the aim to increase his HbA1c slightly without large swings in glucose levels. Mr E explained his unwanted physiological symptoms of hyperglycaemia and hypoglycaemia and very much wished to maintain more steady glycaemic management.

Mr E enjoyed looking at the Libre App on his phone utilising the colour-coding to know that he was doing well. Refer to figure 1.

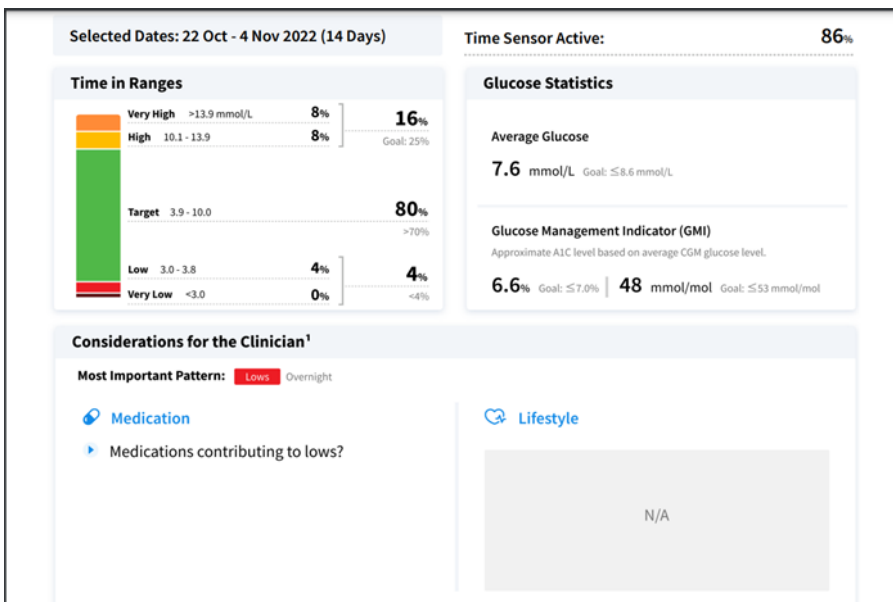


Figure 1

We used the Daily Glucose Profiles to discuss foods eaten on some days and ascertain that Mr E may have been forgetting his insulin doses sometimes.

Mr E started to use his phone alarm to set reminders for his insulin doses. Mr E quickly became aware which dinner meals affected his glucose levels the most.

Eating healthier also resulted in some weight loss, which Mr E was happy about.

In consultation with his GP, his insulin doses were reduced as we saw a pattern of early morning hypoglycaemia following the improved dinner meals.

Conclusion

The use of the Libre 2 sensor continued, as Mr E valued the technology, as did his GP, therefore we applied through his supports at DVA to continue to fund the technology, noting the improvements in hypoglycaemia awareness and prevention, and use for mealtime education. Liaising with his GP, we could also adjust insulin doses as required.

While Mr Es glucose management remained relatively similar over time, it can be seen in figure 2 that his glucose management indicator did increase from 6.6% to 7.0%, potentially a better level for wound healing.

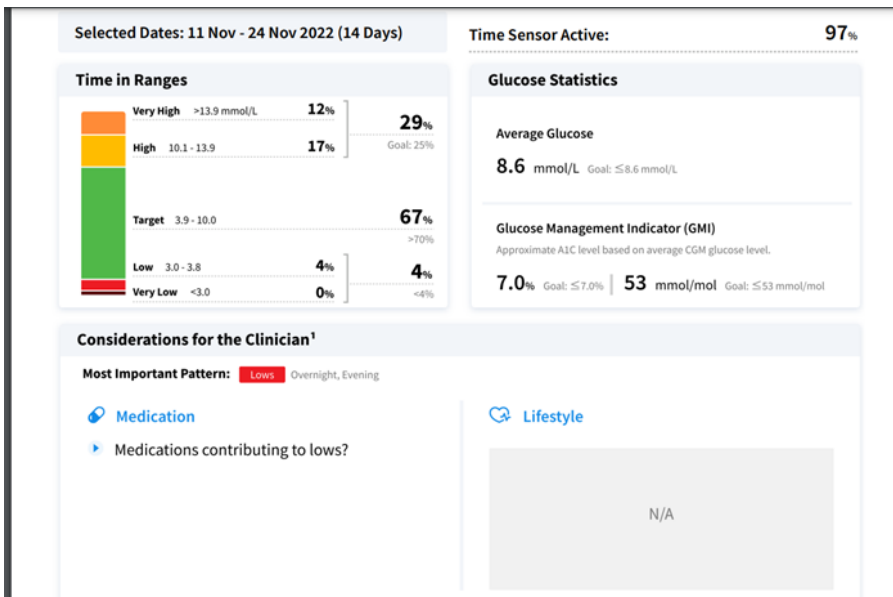
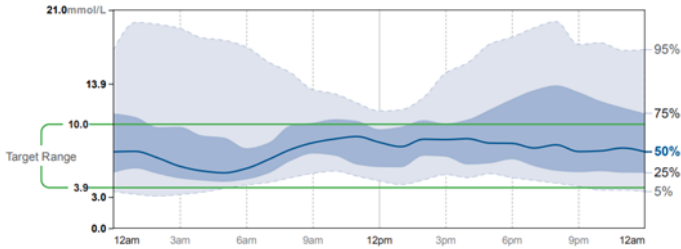


Figure 2

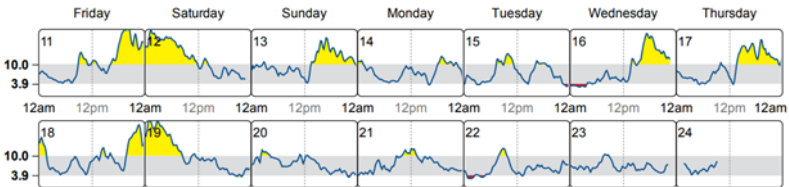
AMBULATORY GLUCOSE PROFILE (AGP)

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

Figure 3

Over time the hyperglycaemia and hypoglycaemia events didn't change a lot, however there was increased peace of mind for Mr E and his GP that these events were able to be monitored and potentially avoided, especially considering his social situation.

Mr E has become a lot more aware of his dietary management of diabetes and has very much improved his nutritional intake. His schnitzels and burgers have changed to salmon, vegetables or salad, and his breakfast cereals to an egg and avocado on toast. He is able to prevent a hypo if he can see the trend arrows, and this has given him a lot more confidence in preventing the ill feeling he experiences when he has low blood glucose.

Overall, the Libre 2 flash glucose monitoring system has been utilised as a great teaching tool as to the many areas of life that affect glucose levels for Mr E from day to day, not only for him but for nursing staff and his GP also.

Mr Es wound has healed enough that his bulky leg dressing is small enough now to again wear both his footy socks!

References

1. Xiang J, Wang S, He Y, Xu L, Zhang S, Tang Z. Reasonable glycemic control would help wound healing during the treatment of diabetic foot ulcers. *Diabetes Therapy* [Internet]. 2018 Nov 21;10(1):95–105. Available from: <https://link.springer.com/article/10.1007/s13300-018-0536-8>
2. Fesseha BK, Abularrage CJ, Hines KF, Sherman R, Frost P, Langan S, et al. Association of hemoglobin A1c and wound healing in diabetic foot ulcers. *Diabetes Care*. 2018;41(7):1478–85.

Case eight

Daniela Nash

Optimal diabetes management despite the odds

Tom (pseudonym used) is a 44-year-old gentleman, diagnosed with type 2 diabetes in March 2022. He was referred by an Endocrinologist for diabetes education for the commencement of a rapid-acting insulin.

Tom lives with his wife, and he works full-time for the Department of Infrastructure and Transport.

Tom was prescribed oral hypoglycaemic agents (OHAs)- Metformin 1g BD and Gliclazide 120mg BD and had been recently commenced on 20 units Insulin Glargine (U300). Glucose levels were sub-optimal and had been placed on a Freestyle Libre 2 sensor by the Endocrinologist.

This case study will demonstrate the sensor readings 2 months prior to seeing a CDE for education, then 6 months after the commencement of a rapid-acting insulin, learning to carbohydrate count and self-adjusting insulin doses from the information with using the Freestyle Libre 2 sensor.

Assessment

Tom had no family history of diabetes.

Past medical history - chronic pancreatitis due to alcohol dependency. Tom stated that he stopped drinking alcohol 6-7 years prior.

Diabetes medications prescribed - Metformin 1g BD, Gliclazide 120mg BD and 20 units of Insulin Glargine (U300). Nil issues with insulin injecting, he had a great technique. Nil issues with side effects from the OHA's

On assessment, Tom appeared to look very thin, height approx. 6 foot tall and stated that he weighed 65kg. He was eating a wholesome diet and was taking Creon 25000 tds.

Despite this, Tom stated that he felt weak, he had very little muscle tone/strength and was constantly lethargic. It took a lot of strength to get through his work week.

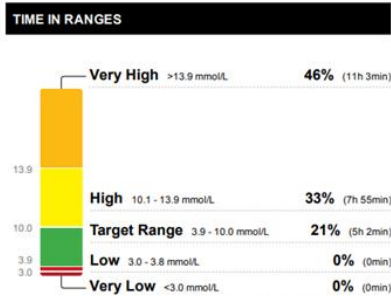
Tom stated that he didn't have enough energy to exercise.

His mental health appeared to be adequate, stating that the lethargy would get him in a low mood at times.

Management

Upon looking at Tom's Libre sensor readings at his first consult with me, his TIR was 21% for the first 60 days.

GLUCOSE STATISTICS AND TARGETS	
20 March 2022 - 18 May 2022	60 Days
Time Sensor Active:	91%
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	14.2 mmol/L
Glucose Management Indicator (GMI)	9.4% or 80 mmol/mol
Glucose Variability	35.1%
Defined as percent coefficient of variation (%CV)	



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.

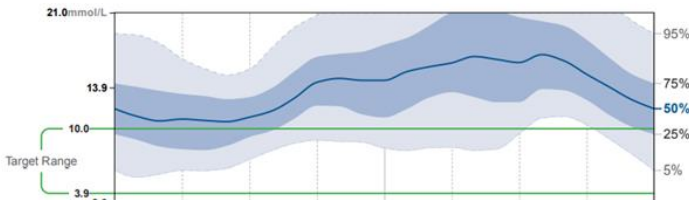


Figure 1

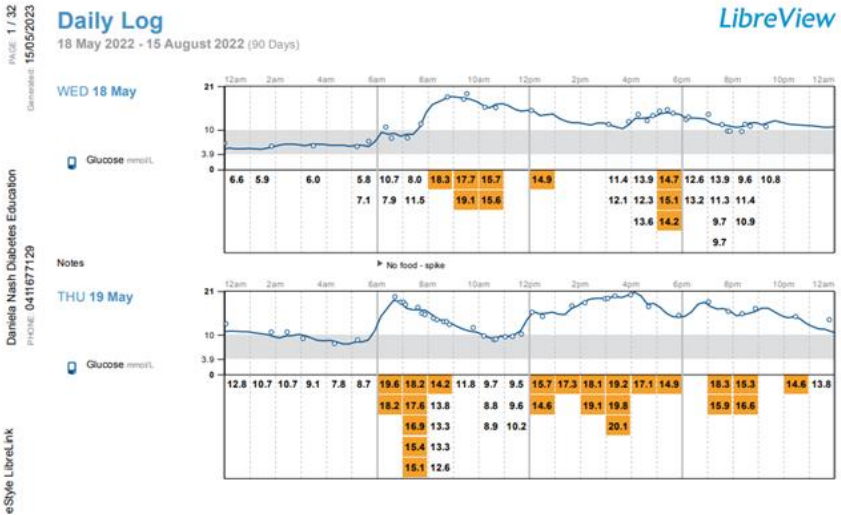
Education given on self-administration of a rapid-acting insulin, Novorapid.

Instructions by the Endocrinologist was to teach Tom carbohydrate counting and start with an ICR of 1:15g. No ISF was given as she wanted to ease him into a basic carb counting regimen.

Education given on the management of hypoglycaemia and being above 5 to drive.

There was a request to the Endocrinologist to reduce the OHA's as Tom was not a typical person with type 2 diabetes. She stated with the addition of the Novorapid insulin, Tom could cease the Gliclazide tablets.

Figure 2 shows glucose peaks post breakfast and post lunch. ICR was adjusted to 1:10g for breakfast and lunch and leave dinner ICR to 1:15g.



Daily Log

18 May 2022 - 15 August 2022 (90 Days)

LibreView

Daniela Nash Diabetes Education
PHONE: 0411677129

le LibreLink

TUE 24 May

Glucose mmol/L

Carbs grams

Notes



WED 25 May

Glucose mmol/L

Carbs grams

Notes



⚡ Feeling fatigued, dizzy

Daily Log

18 May 2022 - 15 August 2022 (90 Days)

LibreView

Daniela Nash Diabetes Education
PHONE: 0411677129

FreeStyle LibreLink

THU 26 May

Glucose mmol/L

Carbs grams

Notes



⚡ Food 15 mins ago

FRI 27 May

Glucose mmol/L

Carbs grams

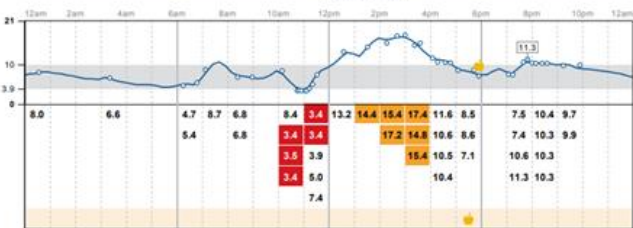


Figure 3

No further insulin adjustment until the 10th of June where Insulin Glargine (U300) was increased to 22 units (Figure 4). Weight is now at 69kg.

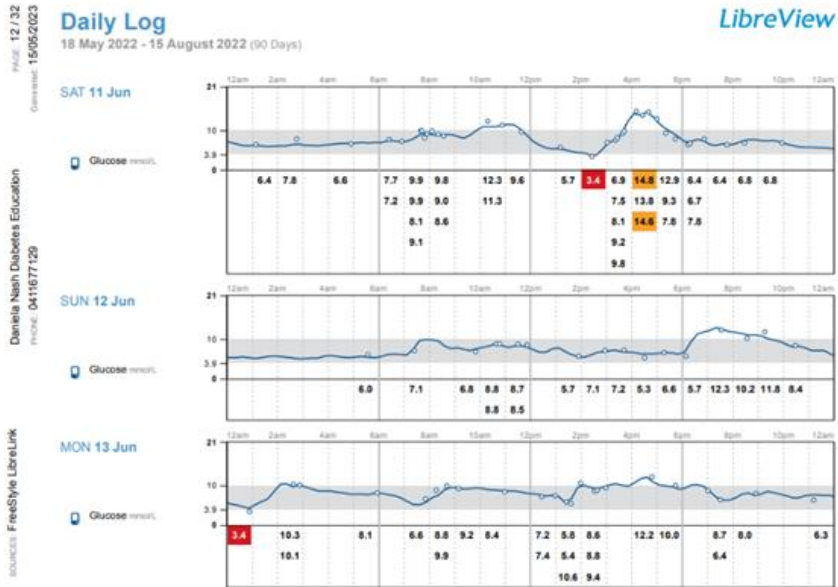


Figure 4

It was discussed with Tom my theory of him potentially not having type 2 diabetes due to OHA's not working adequately and instead due to the chronic pancreatitis that he in fact may have pancreatic insufficiency placing him in the category of having type 3c diabetes.¹

This was then mentioned to the Endocrinologist who agreed to do further tests and check Tom's c-peptide level as well as antibodies for type 1 diabetes.

The c-peptide levels were low, autoantibody for type 1 diabetes were negative. A letter was written to NDSS to change Tom's diagnosis from type 2 diabetes to type 3c diabetes.

Confirmation from Gastroenterologist stated that Tom had pancreatic insufficiency.

Monthly telehealth visits saw Tom’s weight increase to 72.9kg, Insulin Glargine dose adjusted to 28 units, Novorapid ICR 1:7g breakfast and lunch and 1:14g for dinner.

Tom was now seeing a physio once a week to assist with strengthening his back and leg muscles and stated he was slowly improving. The lethargy was not as bad as it was originally but remained.

Three-month AGP report showed an increase in TIR to 58% (Figure 5).

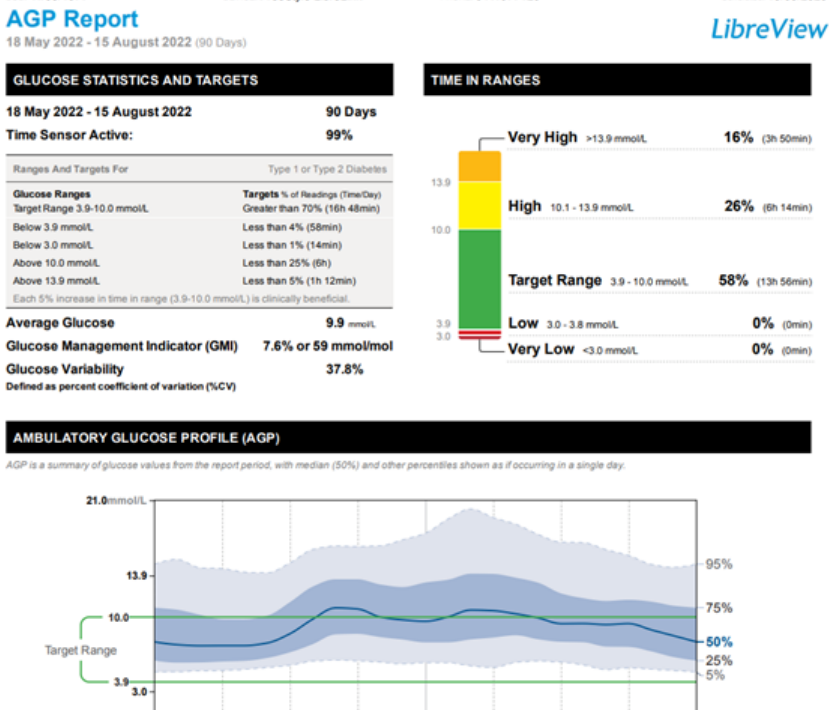


Figure 5

Telehealth reviews were slowing down, Tom began self-adjusting his insulin doses. He mentioned that he was getting more hypos, he was decreasing the Insulin Glargine (U300) slowly and reviewing every couple of weeks.

3 months later (6 months from first CDE consult), HbA1c had reduced to 6.4%. Weight increased to 75kg.

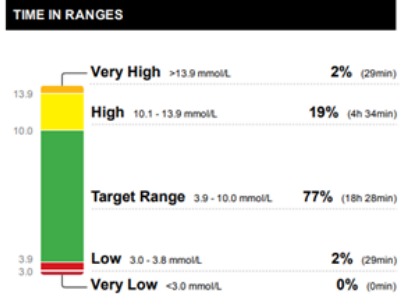
Insulin Glargine (U300) at 21 units. ICR remains the same and ISF was introduced by the Endocrinologist. TIR increased to 77% (Figure 6).

AGP Report

18 August 2022 - 15 November 2022 (90 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS	
18 August 2022 - 15 November 2022	90 Days
Time Sensor Active:	93%
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	8.0 mmol/L
Glucose Management Indicator (GMI)	6.8% or 50 mmol/mol
Glucose Variability	33.4%
Defined as percent coefficient of variation (%CV)	



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.

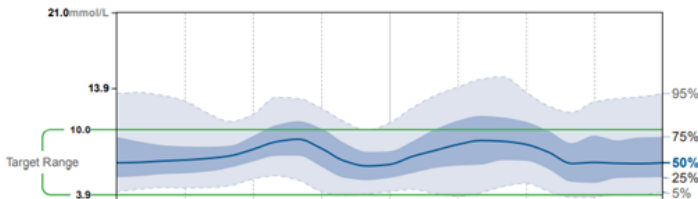


Figure 6

Tom mentioned that with being able to scan his glucose levels as often as he liked, was giving him the freedom to be able to make his own decisions of insulin adjustment according to the food that he would eat. His hypos were manageable as he would receive an alarm and had time to treat them¹.

Conclusion

This case study demonstrates the importance of client self-management education and the turnaround of a GMI of 9.4% to 6.8% and average glucose of 14.2mmol/L to 8mmol/L in just 6 months.

The glucose variability was evident with Tom’s LibreView reports, as Tom was eating a higher caloric diet due to being underweight. This was the reason for the carbohydrate counting at the get-go. Tom could then eat as much as he needed to and give the Novorapid insulin as required.

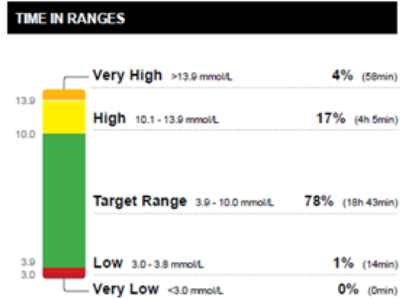
To date, a year after Tom’s first consult, he remains at 78% TIR.

AGP Report

15 February 2023 - 15 May 2023 (90 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS	
15 February 2023 - 15 May 2023	90 Days
Time Sensor Active:	96%
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% (10h 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% (8h)
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	8.1 mmol/L
Glucose Management Indicator (GMI)	6.8% or 51 mmol/mol
Glucose Variability	33.3%
Defined as percent coefficient of variation (%CV)	



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.

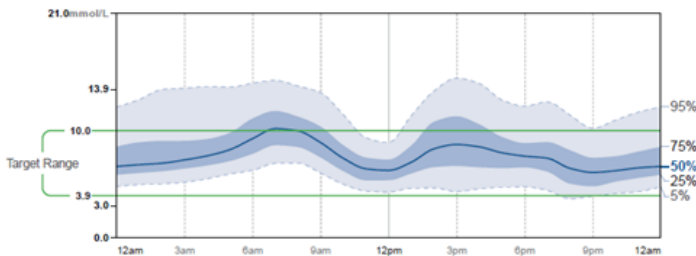


Figure 7

References

1. Lee V, Poynten AM, Depczynski B. Continuous glucose monitoring to assess glucose variability in type 3c diabetes. *Diabetic Medicine Journal* [Internet]. 2022 [cited 2023 May 15];39(8). Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9545045/>

Case nine

Cindy Shea and Catherine McNamara

Managing hypoglycaemia unawareness in older adults with type 1 diabetes

For the purpose of anonymity, the client will be referred to as CS. CS, a 68-year-old male was referred to the dietitian for weight management by his cardiologist to assist with managing hypertension. CS is retired and lives with his wife who does most of the cooking. His medical history includes type 1 diabetes for 48 years, hypertension and hypercholesterolemia. His BMI on initial consultation was 42kg/m² and HbA1c was 7.1%. He has been seeing an endocrinologist who manages his diabetes and had not seen a dietitian or diabetes educator for many years.

On initial consultation with the dietitian, CS had not heard about the continuous glucose monitoring system (CGMS) NDSS subsidy. Initially he was resistant to having a device connected to his body. However, during the consultation CS had a hypoglycaemic episode of which he was unaware. Later his wife revealed that this was a frequent occurrence. After this incident, CS agreed to see a CDE to discuss CGMS's.

Assessment

CS had been on multiple daily injections and self-monitoring blood glucose levels 6-7 times/day. He is on a basal bolus regimen of Toujeo 40 units and NovoRapid 30-35 units with meals, with correction doses and takes Metformin 500mg BD. He 'corrects' if his BGL is elevated, however, he doesn't follow any set formula so correction doses can be erratic and inconsistent.

Upon seeing the CDE, he was shown available CGMS devices, and he chose Freestyle Libre 2. Some reasons were there was one on hand to trial, duration of the device is 14 days, one sensor/transmitter component and ability to set low glucose alarm alert. According to the American Diabetes Association (ADA) Standards of Care for Older Adults, it states 'For older adults with type 1

diabetes, CGMS should be considered to reduce hypoglycaemia. (Level A evidence)¹

CS was educated on how to use Libre 2 – how to insert, set up the phone app, how to scan, set alarms, enter events and interpret the app screen data – in particular the glucose level and the arrow. CS elected to set his low glucose alarm at 3.9mmol/L with a sound plus vibration alert.

Management

CS's management goals were to restore hypoglycaemia awareness and prevent severe hypos. According to the ADA Standards of Care for Older Adults recommendations for CGMS targets are 3.9-10.0mmol/L >50%, >10.0mmol/L <50% of the time, >13.9mmol/L <10% of the time and <3.9mmol/L for <1%.¹

All subsequent reviews were joint CDE and dietitian consultations. The first review was 6 weeks after Libre 2 was commenced. The below AGP report shows CS is meeting the CGMS recommendations as outlined by ADA.

GLUCOSE STATISTICS AND TARGETS

25 November 2022 - 8 December 2022 **14 Days**
 Time sensor active: **95%**

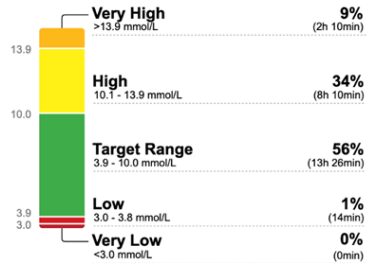
Ranges And Targets For Type 1 or Type 2 Diabetes

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)

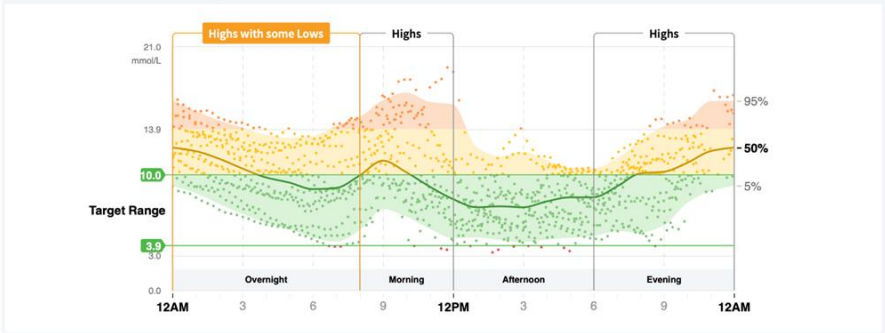
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Average Glucose **9.5 mmol/L**
Glucose Management Indicator (GMI) **7.4% or 57 mmol/mol**
Glucose Variability **32.5%**
Defined as percent coefficient of variation (%CV)

TIME IN RANGES



Glucose Patterns (14 Days)



On average CS was scanning 8 times/day, which demonstrates engagement, and he had better awareness of his glucose levels. He reported utilising the arrows to understand glucose trends and had increased confidence in the Libre 2 to provide information on his glucose levels, which his wife also felt the same and noted reduction in hypoglycaemic episodes. CS did not like the frequent alarms that were occurring. Changes were made to the alert settings to minimise the alarms.

At the second scheduled review, CS had improved his time in range to 59% from 56%. CS had made slight adjustments to his NovoRapid taking 25-33 units with meals, Toujeo was unchanged at 40 units and still taking metformin 500mg BD.

GLUCOSE STATISTICS AND TARGETS

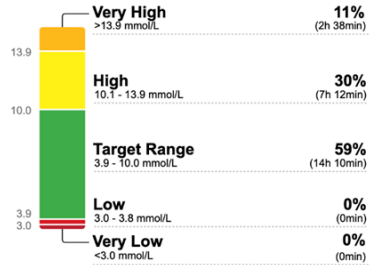
27 January 2023 - 9 February 2023 **14 Days**
 Time sensor active: **97%**

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)	

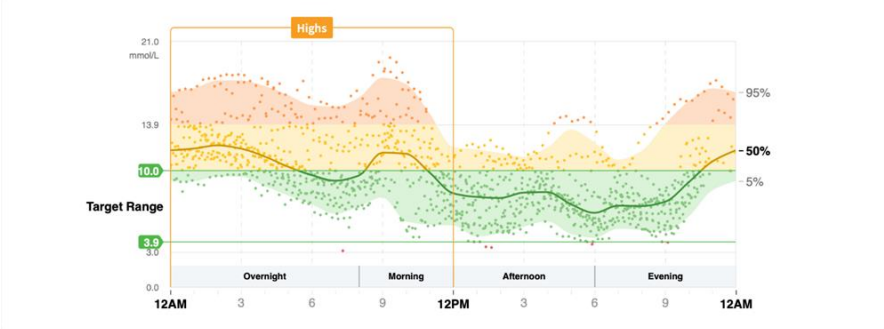
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Average Glucose **9.6** mmol/L
Glucose Management Indicator (GMI) **7.4% or 58** mmol/mol
Glucose Variability **33.7%**
 Defined as percent coefficient of variation (%CV)

TIME IN RANGES

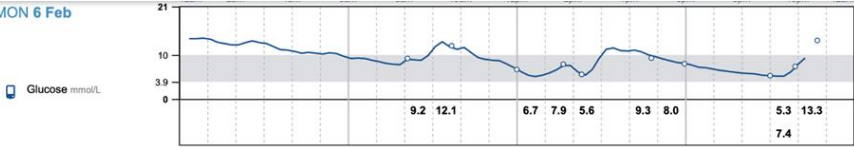


Glucose Patterns (14 Days)

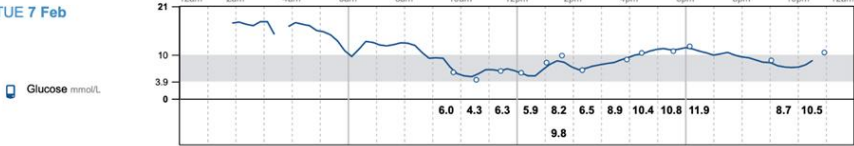


A trend was noticed, if CS's BGL's at bedtime was 5-9mmol/L and trended up, glucose levels would remain elevated overnight until about 8am. CS reported he preferred his glucose levels to be >10mmol/L as he had prior experiences of severe hypoglycaemia episodes overnight. This anxiety about overnight hypoglycaemia prompted CS to have regular snacks prior bedtime. The dietitian suggested switching to lower GI protein-based option to trial, which CS agreed.

MON 6 Feb



TUE 7 Feb



WED 8 Feb



THU 9 Feb



Third review post Libre 2 showed more stable glucose levels, similar occurrence of hypos but clarity in pattern of hypos. These occur in relation to exercise only. CS has been using Libre 2 for 7 months and has more clarity in the impact of food and exercise on his BGLs.

GLUCOSE STATISTICS AND TARGETS

29 April 2023 - 12 May 2023 14 Days

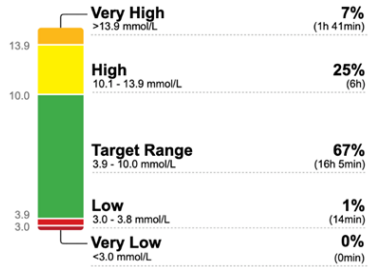
Time sensor active: 95%

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 9.1 mmol/L
Glucose Management Indicator (GMI) 7.2% or 56 mmol/mol
Glucose Variability 32.6%
Defined as percent coefficient of variation (%CV)

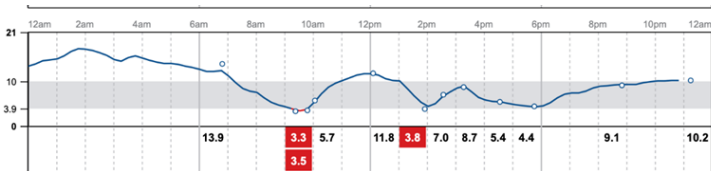
TIME IN RANGES



This knowledge has enabled CS to have greater insight into his diabetes self-management and he was able to understand correction doses vs giving set doses of NovoRapid. Usually, he would add 10 units if BGLs were elevated regardless of activity or carbs. The CDE calculated a correction factor to trial to have pre-meal with mealtime insulin and to reduce a few units if planning exercise.

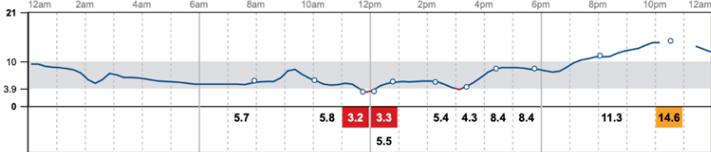
WED 3 May

Glucose mmol/L



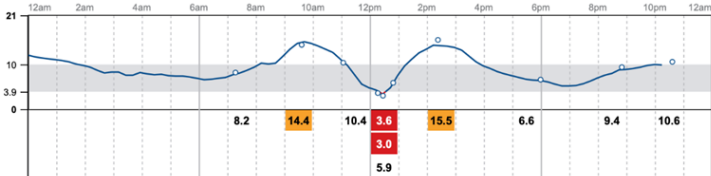
THU 4 May

Glucose mmol/L



FRI 5 May

Glucose mmol/L



Conclusion

Since using Freestyle Libre 2, CS and his wife have felt more reassured with his BGL's, hypoglycaemia management and have reduced stress levels. CS said it had 'made a world of difference to them both'. CS's wife carer burden had reduced as CS is alerted to hypo's and able to self-treat, whereas prior she would need to assist. Overall, CS has been able to meet management goals for older adults for CGMS targets. Most importantly, CS has reduced his incidence of hypoglycaemia, gained hypoglycaemia awareness and increased self-efficacy in diabetes self-management.

His HbA1c from initial consultation was 7.1% and the latest result was 8%. There is a strong possibility that the earlier and lower HbA1c was a result of more time in the low range when he was experiencing more frequent hypoglycaemia. For healthy, older adults with few comorbidities, an HbA1c target of 7-7.5%, is recommended.^{1,2} Since CS has been able to reduce his hypos with increased confidence, he will be able to focus on his high glucose levels and improve his HbA1c.¹

His weight has also reduced by 13kg, due to reduction in portion sizes, daily walks and likely reduction in hypoglycaemia management.

Overall, Freestyle Libre 2 can be a useful tool for those who have not used any diabetes technology in the past, in particular older people with little confidence in managing technology. Also it can assist carers who live or take care of the person with diabetes reduce carer stress and burden.

References

1. ElSayed NA, Aleppo G, Aroda VR, Bannuru RR, Brown FM, Bruemmer D, et al. Older adults: standards of care in diabetes—2023. *Diabetes Care* [Internet]. 2023;46(Supplement 1):S216–29. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9810468/>
2. Dunning T, Sinclair A. *Care of people with diabetes: a manual for healthcare practice*. 5th ed. West Sussex, UK: Wiley-Blackwell; 2020.

Case ten

Janine Wright

Hypoglycaemia after bariatric surgery

Introduction

A Freestyle Libre 2 flash glucose monitoring device was applied to a client who was expressing concern about hypoglycaemia occurring daily at 2.5 years after gastric sleeve, if protein containing food was not consumed 2 hourly during the day symptoms occurred which impacted on her ability to concentrate on work.

The client had lost 60kg post gastric sleeve at 2 years and regained 2 kg with a total loss of 58 kg post sleeve and of BMI 29.2.

The Client exercised regularly daily yoga and either exercise bike or swimming 3–5 days a week.

She competed in the Mile swim at the Busselton Jetty swim in February 2023.

She is married with adult children and works part time as a health professional.

Her Husband has insulin requiring type 2 Diabetes and uses DVA funded Libre 2 sensors.

With her mother having Type 2 Diabetes and the she had gestational diabetes in 2000. This and potential ability to delay type 2 diabetes were motivating factors for her to undergo the gastric sleeve procedure.

Assessment

The first sensor was used of 6 days and failed. It was replaced by Abbott customer care. This sensor provided confirmation of the occurrence of hypoglycaemia. It also provided evidence of elevated glucose levels of 12.3,

11.5 and 13.6 and which are consistent with diagnosis of type 2 diabetes¹, these elevated glucose level were not followed by hypoglycaemia episodes but were related to consumption of CHO of more than 2 servings.

When reviewing The AGP report Time in Range 2% was at high level (10.1-13.9).

After sensor failure the client visited her GP who ordered a HBA1C and fasting blood glucose level these neither of these provided diagnostic levels for diabetes. An oral glucose tolerance test not completed secondary to risk of dumping syndrome.

The second sensor showed nocturnal hypoglycaemia in addition to elevations with simple Carbohydrate and over two 15g servings of Carbohydrate. The replacement sensor was used to assess the cause and effect of dietary changes and exercise.

The client has then self-funded a third sensor which was used to continue the troubleshooting.

In between sensors, the client used self-monitoring blood glucose (SBGM) using the Freestyle Libre reader as a blood glucose monitor.

To establish blood glucose level (BGL) trends, the client repeated lancing. Even then, they often felt unsure of where the BGL were heading and felt early symptoms of hypoglycaemia.

The client was suspected of having reactive hypoglycaemia post gastric sleeve and the plan was to try medical nutrition therapy to manage the hypoglycaemia in conjunction with the FreeStyle Libre sensor to track glucose trends in real time.

Management

The study by Kufurt et al² used Continuous Glucose Monitoring to assess the frequency of hypoglycaemia post gastric bypass and this study encouraged the

client to pursue monitoring with the Libre sensor to understand that symptoms of hypoglycaemia were reflected in the flash glucose monitoring.

SBGM was done with symptoms in the past, but it appears that this was not always useful due to not being able to assess the trends of the glucose levels.

The use of the Libre 2 sensor has enabled the client to assess the success of medical nutrition therapy, the recommendations that can be seen in Suhl et al³ where it is advised that controlled portions of Low Glycaemic index Carbohydrate be spread across the day.

From a practical viewpoint the Chelsea and Westminster hospital patient leaflets⁴ further advise that small food portions are eaten regularly, with low Glycaemic Index Carbohydrate be limited to 30g for meals and 15g for snacks and that protein requirements of 70-100g day should be eaten at all meals.

The recommendations⁴ also include to eat more fibre, avoid alcohol and sugary drinks, and avoid eating and drinking together.

For the client dietary changes included planned snacks 3 hours apart prior to symptoms occurring and due to the nocturnal hypoglycaemia an evening protein snack was better than carbohydrates alone.

Reactive hypoglycaemia was demonstrated when consuming simple carbohydrate, this occurred when snacks had been delayed and the client was feeling hunger.

Food records were inaccurate at times. Luckily, the client was able to retrospectively recall food ingestion and correlate with glucose levels.

Education was provided on 5 to drive, which was achievable by scanning the Libre sensor when getting in the car⁵.

Conclusion

Flash Glucose monitoring using the Freestyle Libre 2 has given the client the ability to understand the importance of planning meals and snacks. With the

insight provided by the FreeStyle Libre 2, the feeling of hunger may be a symptom of hypoglycaemia.

It has empowered the client to take breaks at work to snack. Her close colleagues are aware that she requires snacks to manage her blood glucose.

The client uses the Libre 2 reader as a meter when not wearing a sensor but also admits to monitoring only if she is symptomatic when not wearing a sensor and being frustrated with the inability to track trends on the meter without repeated finger sticks.

After review by an endocrinologist Arcobase was prescribed. The client will begin this next week when she will be working from home to manage the potential side effects of the medication. She plans to use a self-funded sensors to achieve her health goals.

Her current long-term planning includes use of sensor for two weeks every four to six weeks, when changing medication or if symptoms change.

Weight reduction surgery are increasing⁶ and 16.7%⁶ of people who have weight reduction surgery have type two diabetes. It is important to assess and manage reactive hypoglycaemia. The FreeStyle Libre 2 is an effective tool to identify and manage hypoglycaemia.

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Notes

