

**FreeStyle living
with diabetes:
Learning from
case studies
2022**



Your trusted partner in diabetes care

Acknowledgement

ADEA would like to acknowledge the generous contributions from the following members of the Review Panel:

- Lorena Akerman, ADEA Education Team Leader
- Ann Bush, ADEA Board Member
- Karen Crawford, Chair of ADEA Course Accreditation and Standards of Practice
- Rachel Freeman, ADEA Professional Services Manager
- Angela Llewellyn
- Dr Sue-Lynn Lau, Endocrinologist at Westmead Hospital
- Peta Tauchmann, Chair of the ADEA Clinical Practice Committee

Thank you to all those who attended and voted during the case study session at this year's Australasian Diabetes Congress (ADC) for the People's Choice Award.

FreeStyle living with diabetes: learning from case studies 2022 is financially supported by Abbott.



Disclaimer

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4. No responsibility is accepted by ADEA, publishers or the printers for the accuracy of information contained in the text or advertisements and readers should rely on their own enquiries prior to making any decision touching their own interests.
5. The person with diabetes discussed in these published case studies were all de-identified.
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About ADEA

The Australian Diabetes Educators Association (ADEA) is the peak organisation for diabetes education in Australia and is the accreditation body for the diabetes education profession, through the ADEA Credentialling Program.

Among over 2402* members, there are over 1549* 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 also reviews and endorses educational programs developed by external organisations for professional development purposes.

We work 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.

For over 40 years, ADEA has been at the forefront in diabetes education, setting professional standards, core competencies, providing education and leading the way in recognising best practice in diabetes education, diabetes care, and diabetes self-management.

About Abbott

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

**Numbers as of 31 March 2022.*

FreeStyle living with diabetes: Learning from case studies 2022

FreeStyle living with diabetes: learning from case studies 2022 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 will 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 ten case studies are featured in this booklet. Each submission was assessed by members of the panel of judges in a blinded review process. The top four entries were then selected to present at the Australasian Diabetes Congress 2022 (ADC). The winner of the *FreeStyle living with diabetes: learning from case studies 2022* will be decided by the People's Choice Award at ADC.

The case studies are presented here in alphabetical order.

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

Kellie Beckenham

My licence makes me just like my friends, I need it back!

Introduction

A driver's licence for young people is a rite of passage and generally not given a second thought. Except for the teenager living with type1 diabetes, so to have it suspended is exceedingly difficult and can cause a great deal of stress and anxiety especially for my 19-year-old male client who has been living with diabetes since he was twelve. In the past couple of years, he has been managing his diabetes and navigating the transition from childhood to adulthood, from the structure of school to that of the workplace, parental health supervision to health independence. These issues have led to blood glucose levels outside of target range and the specialist suspending his licence, which has caused a standstill with his diabetes management, socialisation with peers and created mental health issues. It is limiting work opportunities as he is worried an employer will not consider him if he doesn't have a licence, more then he worries about telling an employer he lives with diabetes and will require adjustments to accommodate his condition.

Residing in a rural town, several factors have contributed to the situation including a limited number of clinic days, poor relationship with healthcare team, lack of flexibility at work and needing to rely on others to attend appointments. Not to mention the area has been contending with Covid outbreaks, extreme weather, floods, and road closures.

Assessment

The client's goal was clear, 'My licence makes me just like my friends. I need it back!'

The first hurdle was to build a rapport with the young man, previous experiences with Diabetes Educators (DE) had been less than ideal. *'The role of the diabetes health professional is to acknowledge, facilitate, encourage and support the person with diabetes in making informed decisions about their diabetes self-management.'*¹ Building a good working relationship was a key factor in achieving a successful outcome. Contact began with texts and phone calls, this allowed him to control our contact, two weeks later he felt comfortable and arranged an appointment. Communication between our face-to-face meetings is via text, this works well as he feels it is not too intrusive but helps him stay focused.

Having used a different Continuous Glucose Monitor (CGM) with little success, he commenced using the FreeStyle Libre Sensor in November 2021. He found the FreeStyle Libre Sensor far easier to apply and use.

Initial Data supplied showed his Time in Range (TIR) was only 28%, it demonstrated a history of hypoglycaemic events, average glucose as 12.3mmol/L and a Glucose Management Indicator (GMI) of 8.6% which is an improvement on the November HbA1c of 9.7%.

AGP Report

14 November 2021 - 4 December 2021 (21 Days)

LibreView

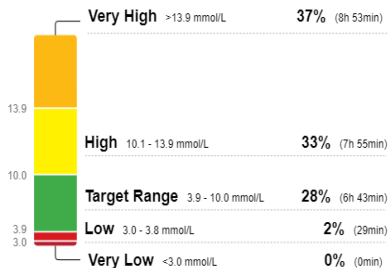
GLUCOSE STATISTICS AND TARGETS

14 November 2021 - 4 December 2021 **21 Days**
 % Time Sensor is Active **36%**

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.	

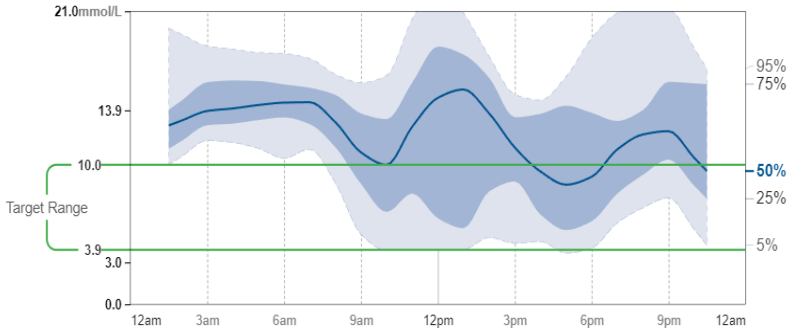
Average Glucose **12.3** mmol/L
Glucose Management Indicator (GMI) **8.6% or 71** mmol/mol
Glucose Variability **36.5%**
 Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



AMBULATORY GLUCOSE PROFILE (AGP)

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



Management

After contacting the endocrinologist, the guidelines he provided were:

- demonstrate stable management
- no hypoglycaemic events
- stop HbA1c from climbing, June 2021 = 9.2% and November 2021 = 9.7%
- work towards reducing HbA1c to 7%.

Steps taken to meet the guidelines:

- He connected to my practice via the FreeStyle LibreLink App to commence sharing data.
- Regular text communication about the data, on average 3 times a week, fortnightly appointments.
- Review AGP Report each fortnight, provide a copy to the specialist.
- Provide education about the information included in the AGP Reports e.g., Time in Range (TIR) target is 75%², looking for patterns around hypo and hyperglycaemia. Discuss how behaviour changes can improve management based on the patterns identified.
- Utilised the logbook and notes section of the FreeStyle LibreLink App

e.g., Adding exercise, food, carbohydrates, insulin doses.

At this time, we added a second SMART goal around these functions, it proved to be extremely helpful. It was noted the blood glucose levels were elevated above 10mmol/L from about 3 pm until about 6 am. he is currently using Levemir twice a day and NovoRapid at 3 units per exchange four times a day. As he starts work at 3:30 am, he was giving the Levemir at 3:00 am and 7:00 pm, this gives only eight hours between Levemir doses but when prescribed twice a day it should be given 12 hours apart.³

As the supporting diabetes educator, I provided the specialist with emailed AGP Reports fortnightly and any recommendations, I then passed on the changes to my client. The initial adjustment was the timing the of Levemir to 12 hours apart and review the affect this has on the AGP Report. Secondly, concentrate and check carbohydrate exchanges to ensure that the correct amount of NovoRapid was being given with meals.

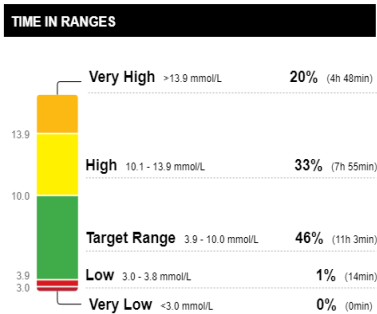
Data in May showed stability in management and an improvement in TIR from 28% to 46%, leading to an improved Glucose Management Index and no hypoglycaemic events. It was the 90-day report that demonstrated improved stability over time. At this time his licence reinstated.

AGP Report

17 April 2022 - 7 May 2022 (21 Days)

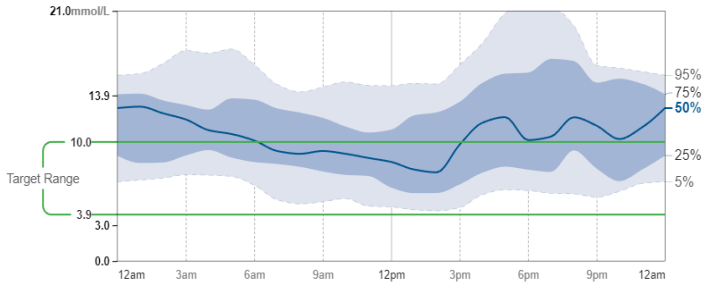
LibreView

GLUCOSE STATISTICS AND TARGETS	
17 April 2022 - 7 May 2022	21 Days
% Time Sensor is Active	61%
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	10.6 mmol/L
Glucose Management Indicator (GMI)	7.9% or 63 mmol/mol
Glucose Variability	36.4%
Defined as percent coefficient of variation (%CV); target ≤36%	

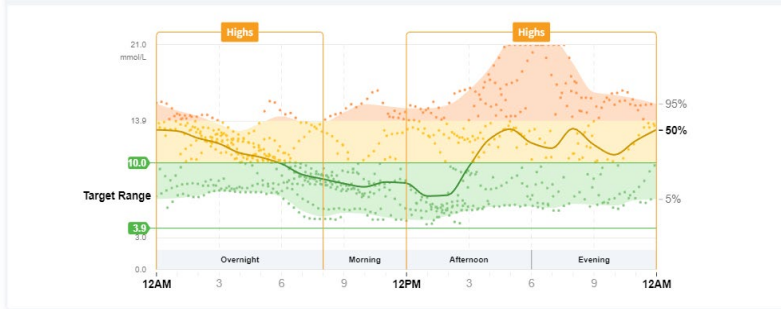


AMBULATORY GLUCOSE PROFILE (AGP)

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.



Glucose Patterns (14 Days)



Device(s): FreeStyle LibreLink

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

Glucose Pattern Insights

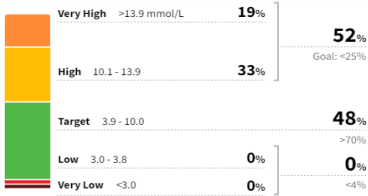
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Selected Dates: 24 Apr - 7 May 2022 (14 Days)

% Time Sensor is Active

61%

Time in Ranges



Glucose Statistics

Average Glucose
10.5 mmol/L Goal: ≤ 8.6 mmol/L

Glucose Management Indicator (GMI)
Approximate A1C level based on average CGM glucose level.
7.9% Goal: $\leq 7.0\%$ | **62** mmol/mol Goal: ≤ 53 mmol/mol

Considerations for the Clinician¹

Most Important Pattern: **Highs** Overnight, Afternoon, Evening

Medication

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

Lifestyle

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

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

AGP Report

29 January 2022 - 28 April 2022 (90 Days)

LibreView

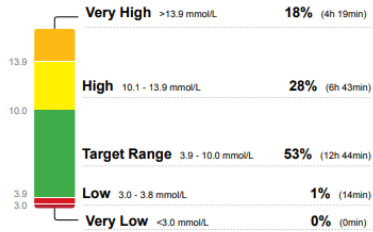
GLUCOSE STATISTICS AND TARGETS

29 January 2022 - 28 April 2022 **90 Days**
% Time Sensor is Active 35%

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)

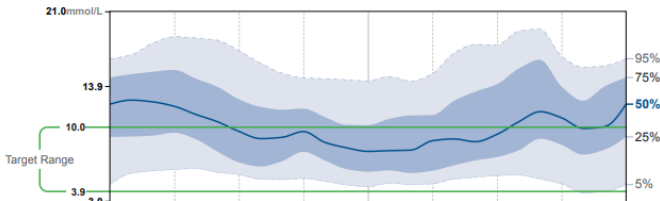
Average Glucose 10.1 mmol/L
Glucose Management Indicator (GMI) 7.7% or 60 mmol/mol
Glucose Variability 39.9%
Defined as percent coefficient of variation (%CV); target $\leq 36\%$

TIME IN RANGES



AMBULATORY GLUCOSE PROFILE (AGP)

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



Conclusion

Due to previous experiences with Diabetes Educators, he was very disillusioned especially when it came to ongoing education and support. He liked that we communicate via text, and it fits better with his lifestyle, and he likes being able to easily contact me for support too. A recommendation around communication with a young adult is to ask, what is the best way for us to communicate? It has certainly helped in this case.

Utilise the full functionality of the FreeStyle LibreLink App, the extra information can help when interpreting patterns, it allowed us to clearly see the issue with the timing of his Levemir injections. Review, analyse and discuss the AGP Report with your client and ensure they are educated about what the data means and what their individual targets are, after all it is the individual's data and optimal outcomes are achieved when they are valued and at the centre of their own care.

This client didn't understand the power of the scan until he was provided further education, he loves that the FreeStyle CGM products work with a phone as everyone carries a phone and allows easy glucose level monitoring, without standing out amongst mates. This helped him get his licence back and began to live his best FreeStyle life.

References

1. [Australian Diabetes Educators Association](#). Person Centred Care for People with Diabetes. NDSS, 2015. 5p
2. <https://freestylediabetes.co.uk/health-care-professionals/freestyle-libre/time-in-range>
Accessed on 25.05.2022.
3. <https://reference.medscape.com/drug/levemir-insulin-detemir-999002>
Accessed on 25.052022

Case two

Andrea Cawte

Keeping clients safe on very low energy diets

Introduction

This is an inspirational story about a 54-year-old man, Bob* and his weight loss journey in the Tertiary Obesity Management Service (TOMS). It is story about how diabetes technology was used to provide timely insulin dose adjustment advice, enabling safe use of a Very Low Energy Diet (VLED) for weight loss. The FreeStyle Libre Flash Glucose Monitoring™ system (FlashGM) was used to monitor glucose levels and interpretation of the data provided feedback to Bob about the impact of the VLED and motivation to continue the program.

Bob* is a morbidly obese male referred to TOMS for weight loss to help manage chronic pain. He lives with this wife and works as a bus driver. His medical history includes insulin dependent type 2 diabetes, depression, peripheral neuropathy and obstructive sleep apnoea.

The initial TOMS, intensive phase program is 12 weeks and the complete model of care includes 12 months of support and education. The program is designed for people who would benefit from weight loss using a VLED. The multidisciplinary approach uses a combination of group education and individual consultations (face to face or virtual) for VLED education, exercise and ongoing support to assist clients to achieve their goals.

Bob* reports that he has been overweight since his 20's and has had limited success with weight loss programs in the past. Reduced mobility has led to inactivity and further weight gain. Bob* says, when it comes to weight loss “I just can budge it”.

**Name has been changed for privacy reasons*

Assessment

Anthropometry: weight 135kgs, height 181cms, BMI 41.21 kg/m² (morbidly obese) and waist circumference 140 cm (target <94cm).

Biochemistry: HbA1c 8.2%

Diabetes Medications: Ryzodeg™ 80 units before breakfast and 80 units before dinner. Metformin™ 2 g/day and Gliclazide™ 120mgs/ day.

Diet: Poor quality, high energy intake and an inconsistent carbohydrate distribution (150-590g/day) contributing to poor diabetes management and obesity. Bob* reports emotional eating.

Exercise: limited due to pain, Bob reports previously bike riding (100km).

Client-centred goals

- To achieve relief from chronic pain
- To increase his chance to achieving type 2 diabetes remission.
- To reduce reliance of Diabetes medication
- To achieve 10% weight loss in 3/12

Rationale for using FlashGM: Blood glucose monitoring provided limited time points and relies heavily on the client. FlashGM enabled titration of medication and gave Bob instant feedback about the progress he was making toward blood glucose management. LibreView™ provided the team with complete and reliable data to titrate the medication.

Management

Initial dietary management included additional protein, consideration of his allergies to gluten, lactose and iodine allergies and monitoring of anthropometry. Counselling about adjustment to lifestyle and adherence to the VLED and monitoring of glucose was included.

PRE VLED	VLED
13.5-20 MJ per day	3.5 MJ per day
Carbohydrate load <ul style="list-style-type: none"> - Breakfast 40g - Lunch 80 - 120g - Dinner 70 - 230g - Supper 0 - 200g 	Carbohydrate load <ul style="list-style-type: none"> - Breakfast approximately 20g - Lunch approximately 20g - Dinner approximately 20g

Table 1: Comparison of diet pre VLED and while on VLED

He commenced a regular exercise routine consisting of a weekly supervised gym routine and a home exercise program to be completed most days. A key message was 'more moving, less sitting'.

FlashGM was commenced, client education on FlashGM provided and LibreView™ data was reviewed daily for the first seven days. Titration of insulin and Gliclazide™ on the first day of VLED with Ryzodeg™ reduced by 50% (40 units twice a day). The main goal at this stage was to prevent hypoglycaemia whilst on a VLED. Particularly important considering his job as a bus driver.

An endocrinologist and APD/CDE to provide insulin dose adjustment managed the dramatic titration of medications in the first nine days (Table 2). See figures 1, 2 and 3 for the daily graph that show the reduction in glucose levels over these 9 day and the AGP on day 1 and the AGP on day nine.

Day on VLED	Changes to medication
Day 1 - 4/4	Ryzodeg 40 BD
Day 2 - 5/4	Ryzodeg 30 BB
Day 3 - 6/4	Ryzodeg 24 BD
Day 5 - 8/4	Ryzodeg 18 BD
Day 7 - 10/4	Ryzodeg 10 BD
Day 8 - 11/4	5 prebreakfast and 0 pre evening meal
Day 9 - 12/4	Ceased insulin and reduced gliclazide from 120mgs to 60mgs daily

Table 2: Changes to medication during the first nine days of VLED

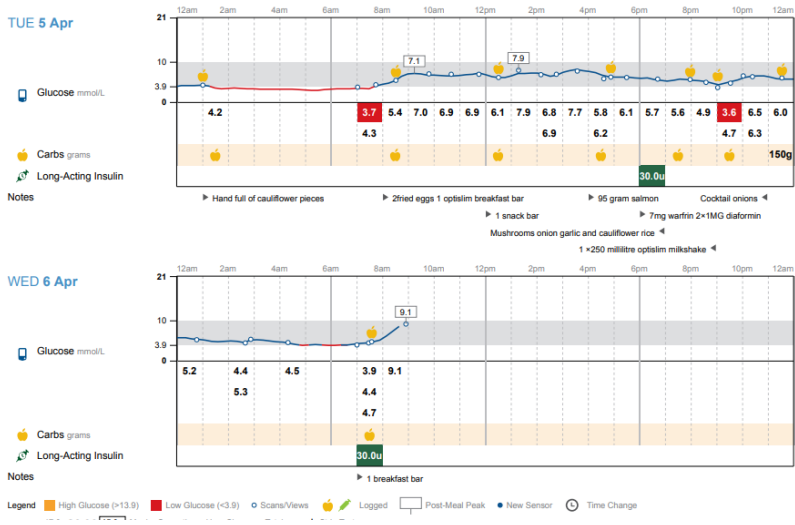


Figure 1: Daily log on day 2 and 3 of VLED

Glucose Pattern Insights

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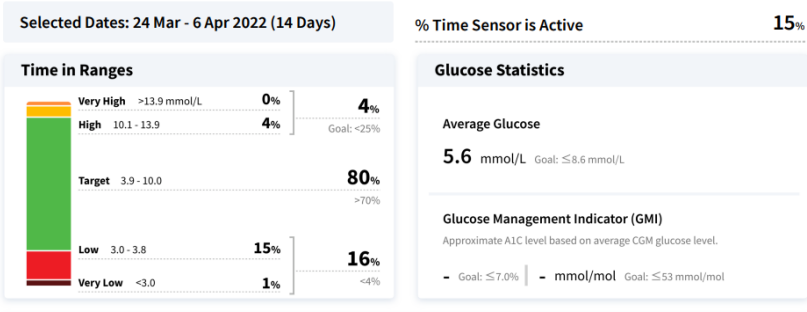


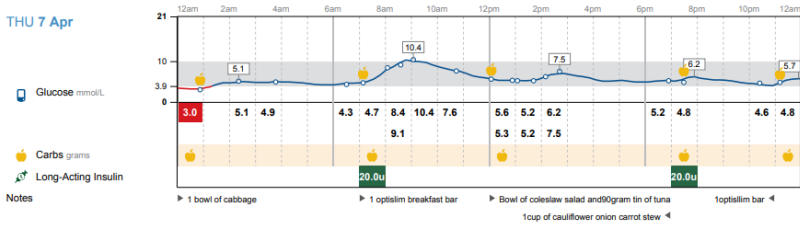
Figure 2: AGP on day 3 of VLED

Daily Log

5 April 2022 - 18 April 2022 (14 Days)

LibreView

THU 7 Apr



FRI 8 Apr

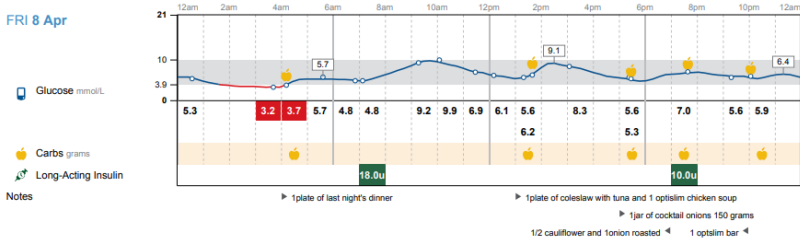


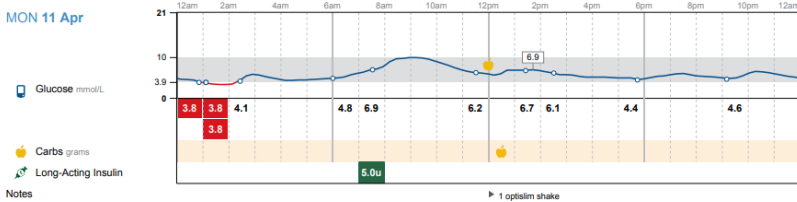
Figure 3: Daily log on day 4 & 5 of VLED

Daily Log

5 April 2022 - 18 April 2022 (14 Days)

LibreView

MON 11 Apr



TUE 12 Apr

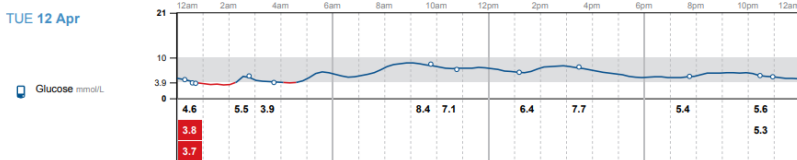


Figure 4: Daily log on day 8 & 9 of VLED

Glucose Pattern Insights

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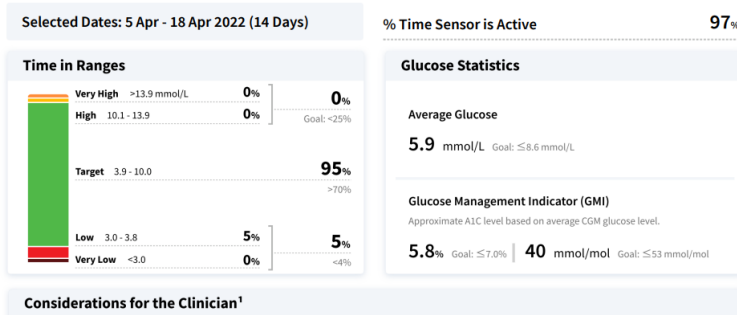


Figure 5: AGP on day 14 of VLED

Conclusion

Bob* achieved several of his goals after only four weeks in the TOMS program using VLED in combination with exercise and diabetes education using LibreView™. Bob* had lost 9.2kgs (7.4% weight loss), ceased insulin and Gliclazide™ and maintained his glucose levels between 4 and 10 mmol/L, 95% time in range. He reports feeling more confident with exercise and more confident at work driving the bus. He said, 'I slept in the for the first time in ages, I had no insulin to give.'

All TOMS participants living with diabetes on glucose lowering agents require careful and timely titration of medications with the initiation of a VLED. FlashGM is invaluable in this situation because it provides glucose data over 24 hours which allows for frequent review and adjustment of medications to prevent hypoglycaemia. In addition to this interpretation of the data provides clients with instant feedback about the impact of dietary changes on their glucose levels. It is incredibly motivating as shown in this case study.

FlashGM and VLED combined have put Bob* on the path to remission of his type 2 diabetes. Together they enable safe, rapid weight loss. LibreView™ is an excellent tool for monitoring glucose while on the diet and allows for remote titration of medications to keep our clients safe by reducing the risk of hypoglycaemia.

Case three

Fiona Lynch

The use of FreeStyle Libre with a client living with type 2 who is on insulin and undergoing bariatric surgery

Introduction

Living in a regional Queensland town, I work privately, as an Accredited Practising Dietitian and Credentialed Diabetes Educator. Bob* is a 48-year-old male, working as a mining dump truck operator on a seven days on, seven days off rotating roster (12-hour day or night shifts). He works in a rural town, 200km away. He has been referred to my clinic to help manage the varying dietary phases pre- and post-operatively, for a gastric sleeve and help him manage his blood glucose levels (BGL's), since he is on insulin. The referral came from the bariatric surgeon. He has been living with type 2 diabetes for 16 years. He has been on Novomix 30 insulin bd for approximately two years. Since then, he reports an estimated weight gain of 10 kgs. His Body Mass Index (BMI), at 38.2kg/m², places him in the obese class II category,¹ when I first met him in June 2021, and he decided to have a sleeve gastrectomy to help address this and help manage his BGL's. His surgery was scheduled for August 2021. Initially, he was taking 68 units bd of Novomix 30 insulin, Gliclazide 60mg, Metformin 1000mg x 2 mane for his diabetes, as well as Atozet 10/80mg for cholesterol and 8mg of Perindopril for Blood Pressure (BP). Additionally, he has Primary Biliary Cholangitis and takes 750mg of Urosalk mane and 1000mg nocte. He is married and lives in a multi-generational household with his son, daughter-in-law and their two children. His main concern is the risk of hypoglycaemia with the varying diet stages before and after his surgery, especially at work, since he reports when fully loaded, the dump truck weighs 600 tonnes!

Assessment

At his initial appointment, Bob* was utilising a Contour glucometer. No pathology was provided, so I had to assess his glycaemic management on his self-monitoring of blood glucose levels. The 90-day average BGL was 11.3mmol/L, with no reported hypoglycaemia, with the lowest BGL being 5mmol/L. He self-monitored BGL's twice a day – before each insulin injection. Pre-operatively, he is required to follow a very low energy diet (VLED) and low carbohydrate (CHO) diet for three to four weeks. His usual diet contains 50-100g of CHO per meal and up to 30g at a snack at work. Hypoglycaemia is the biggest risk identified and he wanted to be able to work safely, right up until his surgery. I offered him a trial FreeStyle Libre 1 Flash Glucose Monitor (FlashGM) to wear for two weeks, to assess BGL trends and he accepted. I provided education. He applied it with my supervision and would be scanning with a reader. We made a review appointment for two weeks' time to review data from his reader. He was to follow his usual diet.

Management

Bob* returned two weeks later. We were able to look at the trends of his BGL's. He had already ordered more FreeStyle Libre 1 sensors to use. At this second appointment, he was about to commence the VLED, which involved a CHO intake of approximately 50-70g a day. After discussion with him and the prescriber, Bob agreed to reduce his Novomix 30 doses upon starting this, to 30 units bd and continue his other medication doses. I advised him to scan his FlashGM four to six times a day, to get a good representation of his BGL trends. He was to contact me with any concerns and would adjust his own insulin doses based on the BGL trends. Unfortunately, his surgery got cancelled, as the surgeon's suburb was placed into COVID-19 lockdown. The surgery was re-scheduled to early October 2021. He rang me and asked for advice. I advised to go off the VLED and eat healthily, adjust his insulin doses accordingly and go back on the VLED mid-September. The week before his surgery, he was on 38 units bd of Novomix 30. Time in range (TIR) was 82%. Target is >70%.² I discussed the two-week fluid, two-week puree and two-week soft diets required, following his bariatric surgery. Subsequently, he had changed to the FreeStyle Libre 2 sensors and was using the mobile phone App

to scan his BGL's. Hence, I added him to my LibreView practice account. We were able to use the various reports from this, such as the low glucose events and average BGL to help identify trends and for him to adjust his insulin doses accordingly. On the day of his surgery, he weighed 117.4kg. The day after his surgery, the surgeon had restarted his Novomix 30 at 20units bd. Bob* was told to adjust his insulin doses according to FGM. I have continued to see him post operatively approximately 1/month, meanwhile keeping an eye on his FlashGM results in my LibreView account. Three weeks after his surgery TIR was 93%. To date, he has lost over 40 kilograms (31.7% of body weight). Currently, his insulin doses are 28 units mane and 10 units nocte of Novomix 30. Interestingly, his other medications remain unchanged. Appendix 1 shows his weight history since our first appointment and Figure 1 shows his latest Ambulatory Glucose Profile report. His average BGL over the last month are 7.1mmol/L. I have a review appointment with him in eight days, so this report will allow further discussion in relation to his low glucose events and insulin adjustments, as well as his sensor usage.

AGP Report

8 May 2022 - 4 June 2022 (28 Days)

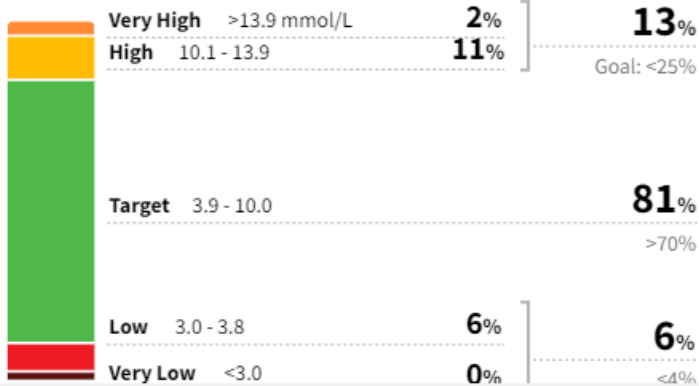
GLUCOSE STATISTICS AND TARGETS	
8 May 2022 - 4 June 2022	28 Days
% Time Sensor is Active	51%
Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	Targets % of Readings (Time/Day)
Target Range 3.9-10.0 mmol/L	Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	
Average Glucose	7.1 mmol/L

Figure 1 - FreeStyle Libre reports

Glucose Pattern Insights

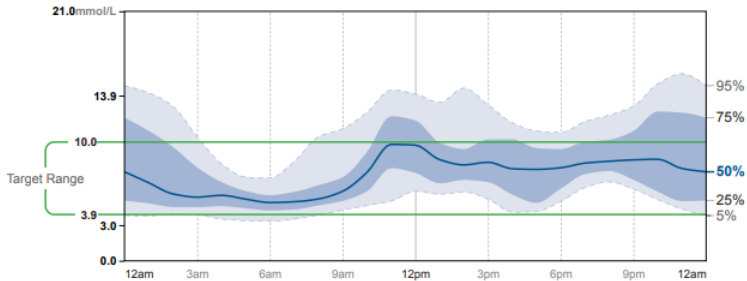
Selected Dates: 22 May - 4 Jun 2022 (14 Days)

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.

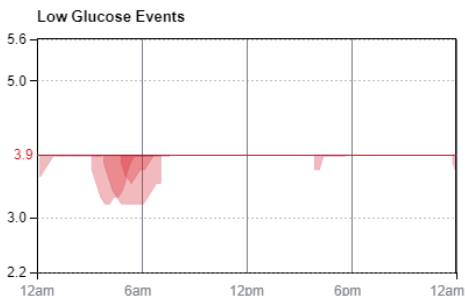


LOW GLUCOSE EVENTS

5

Average duration

182 Min



Conclusion

In summary, FlashGM has provided many benefits for Bob. These have included: being able to work safely, nil finger pricks, minimal low glucose events, increased self-management of his T2DM and safe insulin titration. This was very patient-centred. Considering that T2DM prevalence is increasing³ and so is the incidence of overweight and obesity,⁴ the combination of managing BGL's for patients with type 2 diabetes on insulin, undergoing bariatric surgery is likely to rise. The cost of bariatric surgery is approximately \$25,000, so this additional outlay to utilize the FreeStyle Libre FlashGM system is negligible and provides confidence and safety for both the client and the clinician.

Appendix 1- Weight History

Date	Weight (kg)	Waist (cm)	BMI (kg/m ²)
28/6/21	125.2	132.5	38.2
13/7/21	128.8	133	39.3
1/10/21	121.4	129	37.0
7/10/21	117.4	Date of surgery	35.8
26/10/21	106.8	121	32.6
24/11/21	103.8	117	31.7
14/12/21	100.8	115	30.7
24/1/22	96.5	111	29.46
21/2/22	97.9	110	29.8
22/3/22	93.5	107	28.5
29/4/22	95.1	106	29.0
5/6/22	88	Self-reported	26.86

Height: 181cm

References

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4. Australian Institute of Health and Welfare. Overweight and obesity [Internet]. Australian Institute of Health and Welfare. 2020. Available from: <https://www.aihw.gov.au/reports/australias-health/overweight-and-obesity>

Case four

Nicole McClure

A powerful tool for lifestyle change

Introduction

Health outcomes for Australia's First Nations peoples in remote areas are poor, with high rates of potentially preventable complications.^{1,3} This case study explores how intermittent use of FreeStyle Libre (FL) over 6 months led to improved diabetes self-management for a 49-year-old Aboriginal woman from a remote Australian town.

Jennie is a single mother. Her ten-year-old son, who is living with a disability, lives with her. She has three adult children. Jennie was referred to a Credentialed Diabetes Educator (CDE) at the local Aboriginal Controlled Health Organisation (ACHO) by an Aboriginal Health Practitioner (AHP) who was very concerned about Jennie's high blood glucose levels (BGL's) and kidney function.

Jennie was diagnosed with type 2 diabetes ten years earlier (2009) during a routine health assessment at the ACHO. She had a strong family history of type 2 diabetes, her father has insulin requiring type 2 diabetes, and her weight at diagnosis was 132kg. She was prescribed Janumet 50/1000mg two daily at night, Exenatide XR (Bydureon) 2mg weekly, Gliclazide 30mg one in the morning, and Rosuvastatin 20mg one daily.

Assessment

Jennie works full-time. Her busy work schedule and family commitments were barriers to coming in for appointments or being available for telehealth. Jennie did not attend any planned CDE appointments between July 2019 and July 2020. I saw her opportunistically on three occasions during this time, facilitated by the AHP when she presented to the clinic for another reason.

At the first meeting in July 2019, Jennie’s weight was 106kg, BMI 36.7, BGL 16.2mmol/L and BP 116/85. She had macroalbuminuria and HbA1c of 8.8% with last diabetes monitoring in January 2019 (Figure 1). A point of care HbA1c check that day was 9.2%.

Date	Glucose	HbA1c	eGFR	Urinary Albumin	ACR	Total Cholesterol	Triglycerides	HDL	LDL
Jan 2019	10.8mmol/L (Fasting)	8.8%	>90	5096	241.5	2.3	1.7	0.76	0.8

Figure 1

Jennie did not monitor her BGL’s except when at the ACHO. She had an ‘old meter’ and could not get it to work. She was waking up tired and coming home from work physically and mentally exhausted. She described feeling overwhelmed, ‘fed up and over it’. These feelings, along with non-attendance at appointments, unhealthy eating and disengagement from self-care were consistent with burnout and diabetes distress.²

Jennie understood that her food intake, work and family stress, and recent weight gain could be causing high BGL’s. She was anxious about the effect of high BGL’s in the short and long term and her ability to look after her young son and was desperate to make a change to improve this.

Jennie’s goal was to do some structured BGL monitoring before and two hours after meals with a new BGL monitor, then see the general practitioner (GP) to review her medication and diabetes management.

Management

The health team (GP, AHP, CDE) focused on encouraging engagement and attendance, providing supportive, empathetic care and building rapport and trust with Jennie. Consultations involved reflective non-judgemental listening, and summarising Jennies main issues and concerns and agreeing on an action plan that Jennie felt she could manage.²

Between July 2020 and May 2021 her glycaemia, mental health and wellbeing worsened.

When next seen in May 2021 Jennie was prescribed Metformin XR 1g two daily, Dapagliflozin 10mg one daily, Dulaglutide (Trulicity) 1.5mg weekly, Escitalopram 10mg ½ daily, Rosuvastatin 20mg one daily, and Perindopril 8mg one daily. Her weight was 105kg, BMI 36.3, BP 104/89, random BGL 19.4mmol/L and last diabetes monitoring was April 2021 (Figure 2).

Date	Glucose	HbA1c	eGFR	Urinary Albumin	ACR	Total Cholesterol	Triglycerides	HDL	LDL
April 2021	15.9mmol/L (Random)	10.2%	>90	1077	145.5	3.1	3.0	0.97	0.8

Figure 2

Jennie was ambivalent about BGL monitoring, repeatedly expressing the desire to, but not doing so. High BGL's over the previous two years increased her risk of potentially preventable diabetes complications.³

Insulin therapy was recommended but Jennie was resistant to the idea because of concerns about weight gain. She believed dietary change, regular exercise and reducing stress would improve BGL levels. Jennie was ready to change, taking two weeks off work to prioritise her health.

The ACHO was offering FL sensors to people as part of a small trial. The rationale for using FL was to assess glycaemia, inform management changes to reduce BGL's, assist Jennie to recognise how lifestyle choices affect BGL's, and increase her confidence and motivation for behaviour change.

The AHP assisted with downloading sensor data from the FL reader with CDE support via telehealth in addition to face-to-face visits. The first sensor was downloaded on 24 June 2021, showing a time in range (TIR) of 1%, and 99% time >10mmol/L (Figure 3).

GLUCOSE STATISTICS AND TARGETS

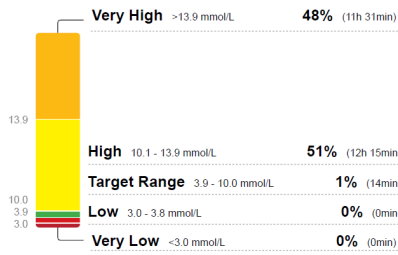
11 June 2021 - 24 June 2021 **14 Days**
 % Time Sensor is Active **72%**

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 **13.4%**
 Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



AMBULATORY GLUCOSE PROFILE (AGP)

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

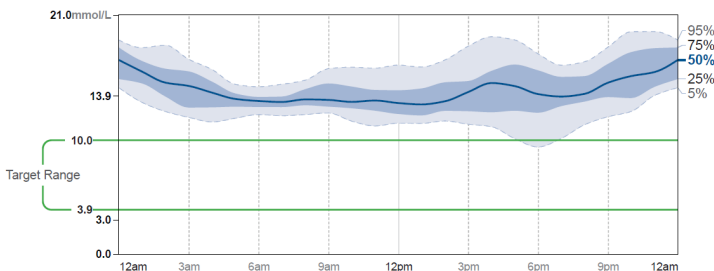


Figure 3

Jennie noticed higher glucose levels in the evening which related to a pattern of eating continuously in the afternoon after work and snacking on lollies during the night. She had decided to resign from her job to reduce work and family stress.

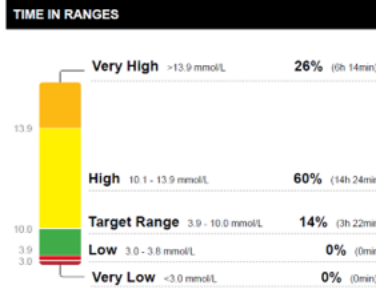
Jennie used a total of 5 FL sensors from June 2021 (Figure 4 and 5), engaged regularly with her care team and demonstrated gradual glycaemic improvement with TIR 86% and 14% time >10mmol/L in January 2022. This was achieved mainly through lifestyle change. Dulaglatide was changed to Semaglutide (Ozempic) in November 2021.

AGP Report

1 July 2021 - 14 July 2021 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS	
1 July 2021 - 14 July 2021	14 Days
% Time Sensor is Active	69%
Ranges And Targets For <small>Type 1 or Type 2 Diabetes</small>	
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% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
<small>Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.</small>	
Average Glucose	12.5 mmol/L
Glucose Management Indicator (GMI)	8.7% or 72 mmol/mol
Glucose Variability	18.0%
<small>Defined as percent coefficient of variation (%CV); target <36%</small>	

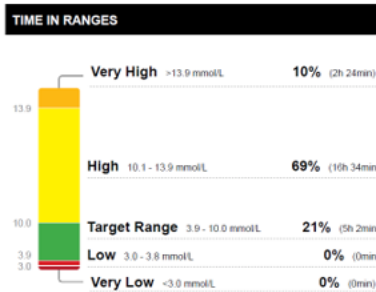


AGP Report

23 July 2021 - 5 August 2021 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS	
23 July 2021 - 5 August 2021	14 Days
% Time Sensor is Active	84%
Ranges And Targets For <small>Type 1 or Type 2 Diabetes</small>	
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)
<small>Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.</small>	
Average Glucose	11.4 mmol/L
Glucose Management Indicator (GMI)	8.2% or 66 mmol/mol
Glucose Variability	16.6%
<small>Defined as percent coefficient of variation (%CV); target <36%</small>	



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.

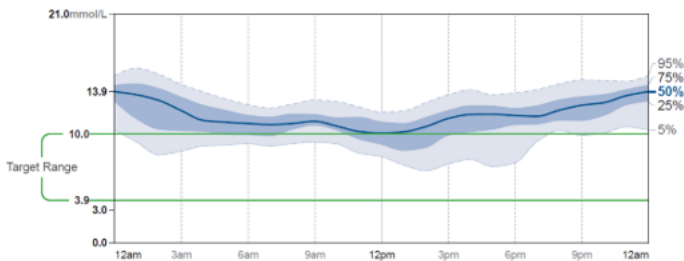


Figure 4

AGP Report

11 December 2021 - 24 December 2021 (14 Days)

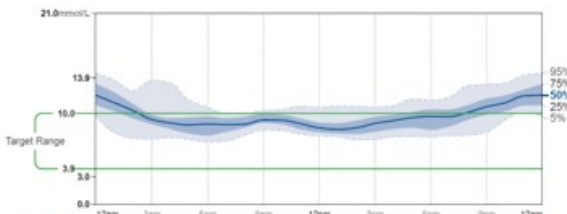
LibreView

GLUCOSE STATISTICS AND TARGETS	
11 December 2021 - 24 December 2021	
14 Days	
% Time Sensor is Active	81%
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-40min)
Below 3.9 mmol/L	Less than 4% (50min)
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)
<small>Each 1% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.</small>	
Average Glucose	9.6 mmol/L
Glucose Management Indicator (GMI)	7.4% or 58 mmol/mol
Glucose Variability	17.3%
<small>Defined as percent coefficient of variation (%CV); target <36%</small>	



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.



AGP Report

6 January 2022 - 19 January 2022 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS	
6 January 2022 - 19 January 2022	
14 Days	
% Time Sensor is Active	66%
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-40min)
Below 3.9 mmol/L	Less than 4% (50min)
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)
<small>Each 1% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.</small>	
Average Glucose	8.2 mmol/L
Glucose Management Indicator (GMI)	6.9% or 51 mmol/mol
Glucose Variability	17.4%
<small>Defined as percent coefficient of variation (%CV); target <36%</small>	



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.

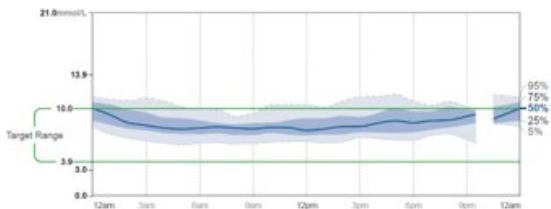


Figure 5

Conclusion

FL has demonstrated benefits for lowering HbA1c, hypoglycaemia and improving quality of life for people living with diabetes on insulin, but there are few studies on their use in people with non-insulin requiring type 2 diabetes.⁴ FL can facilitate a greater understanding of how glycaemia is affected by food, medication, exercise, and stress.⁵

Reflecting back, Jennie felt that BGL monitoring was complicated. Jennie said the FL technology was so simple. Her glucose levels were easily checked, she checked them often and got immediate feedback on how her food and behaviours affected her BGL's. This real-time feedback provided by FL has been shown to be a powerful tool for behaviour change.⁶

Jennie is thrilled with weight loss she has achieved in the past six- months. While barriers around doing more exercise remain, she has maintained other healthy behaviours and improved diabetes management without insulin. In March 2022, her weight was 96.3kg, BMI 33.2, BP 94/72 and her HbA1c significantly lowered (Figure 6) as is her potential risk of avoidable complications. She says using FL was life changing for her.

Date	Glucose	HbA1c	eGFR	Urinary Albumin	ACR	Total Cholesterol	Triglycerides	HDL	LDL
Mar 2022	6.8mmol/L (Random)	7.4%	>90	215 (Nov 21)	82.7 (Nov 21)	2.4	1.7	0.93	0.7

Figure 6

References

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Case five

Daniela Nash

Review of FreeStyle Libre sensor glucose levels pre and post health events

Introduction

David (pseudonym used) is a 58-year-old gentleman, diagnosed with type 2 diabetes in his 20s. He was referred by an Endocrinologist for diabetes management due to glucose levels outside his target range and commencement of an injectable medication (GLP-1 RA).

David lives at home with his wife and two children and works full-time as a teacher.

David is on basal bolus insulin – Protaphane insulin ten units mane and 28 units nocte, and Novorapid insulin five units pre-breakfast and pre-dinner. David has a sensitivity to other insulins; this is the reason for the current regimen.

This case study will demonstrate the sensor readings two months before experiencing four individual health events within ten days of each other, the sensor readings/time in range during the events and two and three months after the health events.

David is very proactive with his diabetes management and throughout the case study, insulin adjustments will be observed, this is David adjusting independently.

Assessment

David has a family history of type 2 diabetes; his father was diagnosed in his mid-80s.

Past medical history – hypertension, managed on oral medications.

On assessment David checked his blood glucose levels two to three times a day, ranging from 7-10mmol/L throughout the day. Symptoms of hypoglycaemia experienced with increased physical activity.

Diet included consuming carbohydrates regularly throughout the day – adequate meal choices consumed for breakfast and dinner; lunch may be missed or consumed in a hurry when working. States eats dessert twice a week. Adequate fluid intake consumed daily.

Insulin injection technique reviewed – nil concerns observed.

Mental health has been an issue in the past. David states that he experienced a breakdown a few years ago. He states that he has Autism and certain activities/events can cause anxiety. David states that he can experience low mood at times, and he states that he can work through it. He has a very supportive family.

Health checks reviewed. David states that he has regular reviews with his GP, Optometrist and Dentist. No recent review with a Podiatrist due to experiencing heightened sensation.

Management

At the initial consult, David was placed on a trial of the FreeStyle Libre sensor for two weeks so that his glucose levels could be observed while being on insulin and adjustments can be made as required.

David was given education on carbohydrate counting and the action and injection technique of the prescribed insulins and how they work together with the prescribed injectable medication.

Figure (Fig.) 1 shows sensor readings for the first 24 hours.

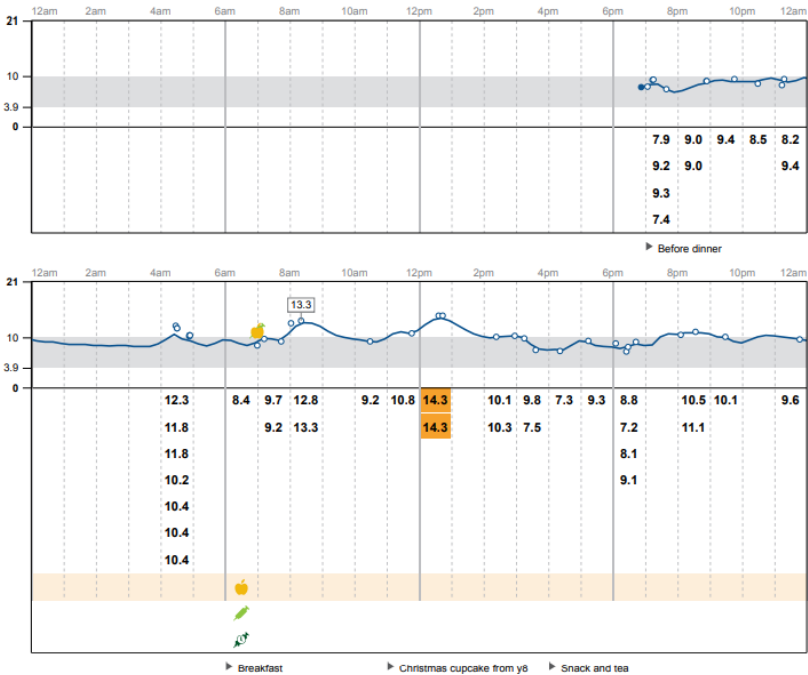


Fig. 1

The regular scanning of the sensor was able to help David manage his insulin adjustments according to his sensor readings and after the 2 week trial, his time in range was extraordinary at 79% (see Fig. 2).



Fig. 2

David mentioned that with wearing the FreeStyle Libre sensor, he was able to adjust his insulin doses accordingly – Protaphane 10 units mane and 20 units nocte, and Novorapid 6 units pre-breakfast and pre-dinner.

David was so impressed with his ability to adjust his insulin doses according to his sensor readings that after the trial period, he decided to subscribe and purchase the FreeStyle Libre 2 sensor.

Fig. 3 shows his achievements in getting a higher time in range the month after commencing on the FreeStyle Libre 2 sensor. David states that he is feeling a newfound freedom and his insulin requirements have decreased further (Protaphane 12 units mane and 14 units nocte, Novorapid 5 units pre-breakfast and 6-7 units pre-dinner) and the GLP-1 RA has taken effect, he has lost 5kgs in the last three weeks.

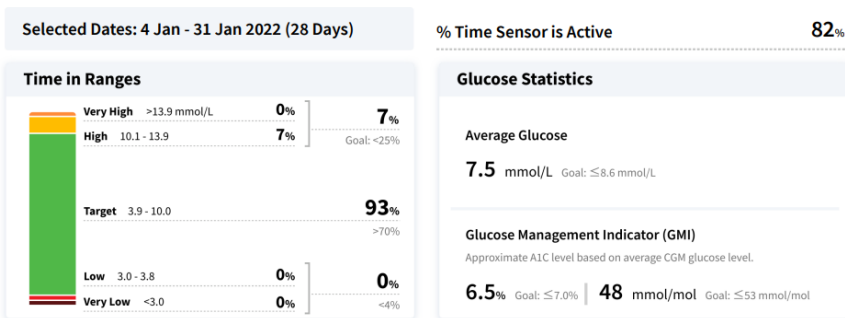


Fig. 3

A sudden health event occurred a couple of months after the commencement of the FreeStyle Libre 2 sensor; David had a heart attack.

A week later, David experienced a stroke, anaphylaxis from an IV dye and the covid virus. He recovered well and had minimal side effects from the stroke.

FreeStyle Libre 2 sensor readings increased, and David mentioned that he had difficulty with adjusting his insulin doses with his sensor readings and he started to feel inadequate (see Fig. 4). It was discussed that it will take time for

sensor readings to settle after having four major events within ten days. Time in range decreased to 46%.

Education was given that especially after a traumatic event, the body responds with raised glucose levels and the need for a higher dose of insulin until recovery may be required.¹

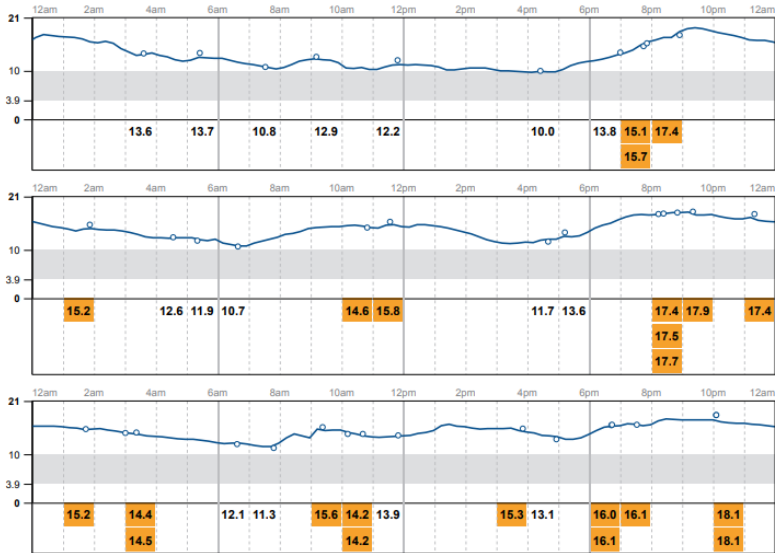


Fig. 4

Fig. 5 demonstrates the increased time in range, approximately eight weeks post health events. David has been quite harsh with himself stating that he is disappointed that he is not able to achieve near normal sensor glucose levels. It was discussed the fantastic efforts displayed by the increased time in range in spite of the major health events experienced.²

David stated that he had returned to work around three to four weeks earlier for two to three days a week – he has been struggling with keeping up his energy levels by the end of each week. Attendance of a six-week cardiac rehab program was commenced.

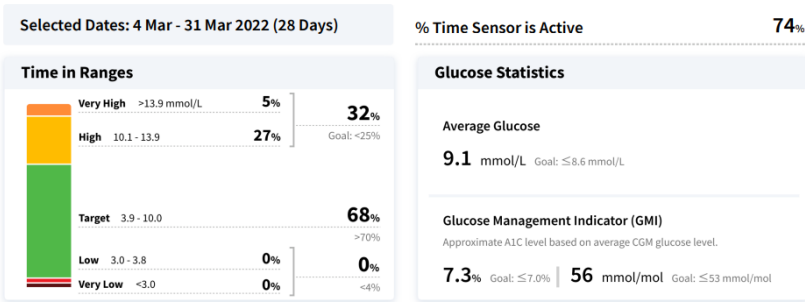
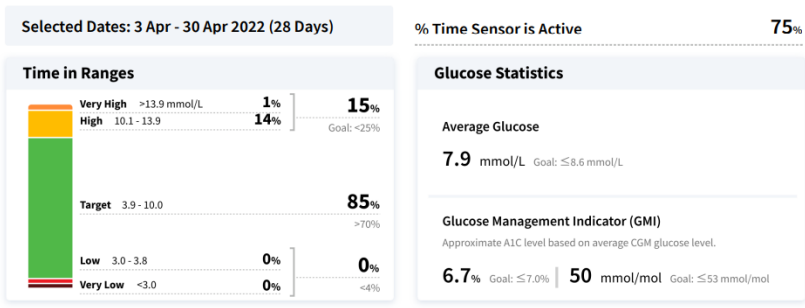


Fig. 5

Encouragement given that as time progresses, David’s sensor glucose will settle. David was comforted with this thought.

Fig. 6 demonstrates that after 12 weeks of recovery, with returning back to work, having had adequate rest and food intake, sensor glucose levels have returned within target ranges and time in range is at the optimal level of 85%.²



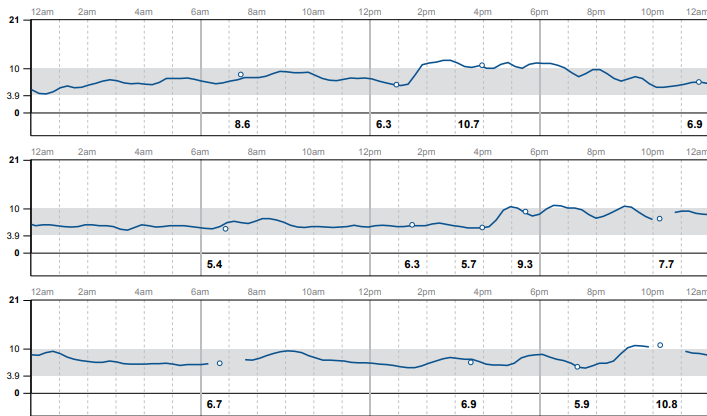


Fig. 6

David's insulin doses have now settled to Protaphane 18 units mane and 14 units nocte, Novorapid 8 units pre-breakfast and 10 units pre-dinner. GLP-1 RA remains at a stable dose and not experiencing side effects.

David states that his understanding has grown and has a newfound freedom to be able to adjust how he manages his diabetes with the FreeStyle Libre 2 sensor.¹

Conclusion

This case study shows the importance of providing diabetes self-management education- David understood the effect of lifestyle factors, the action of diabetes medications and how they correlate with glucose levels.

By giving David the tools in managing diabetes and introducing him to the FreeStyle Libre 2 sensor, he was able to observe the effects of glucose levels according to his diet, exercise and medications.

Even though David experienced significant health events, the FreeStyle Libre 2 sensor readings helped him to adjust his diabetes management in his recovery and beyond. The FreeStyle Libre 2 sensor has helped David achieve a better quality of life.

Reference:

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2. Krakauer, M., Botero, J.F., Lavalle-González, F.J. et al. 2021. A review of flash glucose monitoring in type 2 diabetes. *Diabetol Metab Syndr* 13, 42 (2021). <https://doi.org/10.1186/s13098-021-00654-3>

Case six

Cheryl Poole

It's never too late to teach an old farmer new tricks

Introduction

Max* is an 83yo self-funded retiree living at home on the dairy farm with his wife. He was diagnosed with renal cancer in August 2021 and commenced immunotherapy. Max received a combination of Ipilimumab followed by Nivolumab. Immunotherapy aims to boost the body's own immune system by boosting T cells to fight cancer cells. Unfortunately for Max, in less than 1% of cases endocrine toxicity occurs and there is complete irreversible beta-cell destruction.¹ Max has no history of diabetes however his granddaughter does have type 1 diabetes (T1DM).

In February 2022, Max presented to a large regional hospital with delirium, severe hyperglycaemia (60 mmol/L), low C peptide levels, dehydration, weakness and hypotension without significant ketosis. Hyperosmolar hyperglycaemic syndrome (HHS) was diagnosed. HHS is a potentially life-threatening metabolic imbalance with a mortality rate of up to 20%.²

Assessment

With a new diagnosis of T1DM accompanied by a decline in cognition and overall health Max's wife was overwhelmed with how they would manage. Both Max, and his family wanted to see him return to the farm. After initial treatment in intensive care Max was transferred to a small regional hospital close to home. Max had been commenced on twice daily mixed insulin (Ryzodeg 70/30) and midday short acting insulin (Novorapid). Max was not impressed with finger pricking stating it was "worse than the cancer".

Identifying barriers to self-management was important when developing a management plan. Max was too unwell to take sole responsibility for his

diabetes management. Initial education was given to Max's wife and family including blood glucose monitoring, injection technique, and technology options. The family opted to trial continuous glucose monitoring (CGM). For many of the nursing and medical staff this was their first exposure to CGM technology too. Max did not hold a concession card to obtain funded CGM however, the benefit provided by reduction in finger pricks, continuous monitoring and simplicity made CGM desirable. Social Work successfully supported Max to gain approval for a Seniors concession card to enable funded access to CGM.

Our diabetes educator taught his family how to apply CGM and how to use the sensor data to predict the rise and fall in glucose levels. Max returned to the farm supported by his family who were growing in confidence. District Nursing were able to visit Monday to Friday for the first two weeks to support Max and his wife in the community.

Management

A simple regime for Max provides quality of life and safety whilst reducing burden. Establishing glucose targets to prevent glycaemic emergencies and avoid harm was essential.³ In older people taking glucose-lowering medications and at risk of hypoglycaemia, a blood glucose range of 6–15 mmol/L is recommended.⁴ Fig 1 shows glycaemic management achieved with a simple insulin regime and insightful CGM.

AGP Report

20 May 2022 - 26 May 2022 (7 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS	
20 May 2022 - 26 May 2022 7 Days	
% Time Sensor is Active 100%	
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	31.1%
Defined as percent coefficient of variation (%CV); target ≤36%	

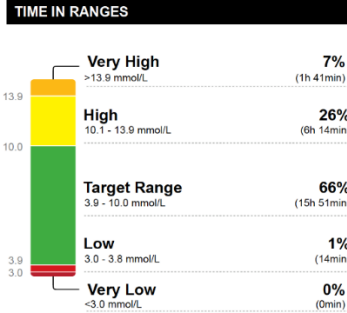


Fig 1 AGP statistical data identify's the length and severity of hypoglycaemic events

After discharge from the acute setting, LibreView cloud-based management system allowed the community healthcare team to continue to support Max and his wife remotely. Our diabetes educator could review glucose patterns and trends to assist Max and his wife to make the necessary changes.

Daily Log

20 May 2022 - 2 June 2022 (14 Days)

LibreView

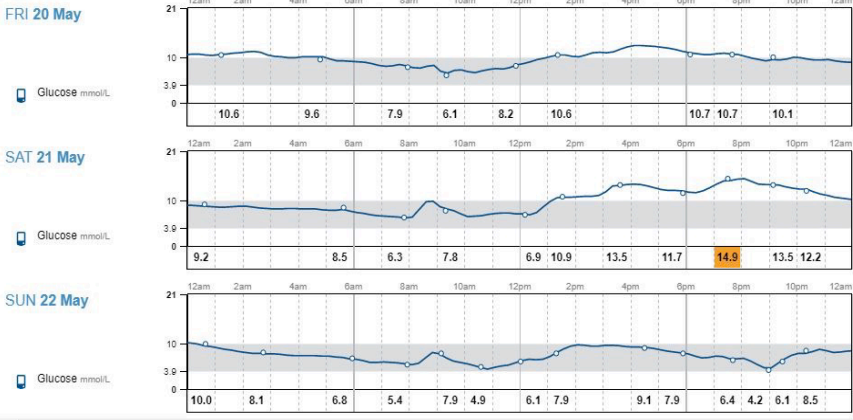


Fig 2 Daily Log showing daily pattern of glucose levels

Ambulatory glucose profiles could be reviewed weekly and downloaded prior to GP visits or reviewed prior to Endocrinologist telehealth appointments. A multidisciplinary diabetes team involving a diabetes educator, dietitian, General practitioner, Endocrinologist and Oncologist from multiple organisations and geographically distanced could work together to deliver comprehensive care with insightful data provided by LibreView.

Fig 3 shows data reviewed which enable the team to make treatment decisions in collaboration with Max and his family.

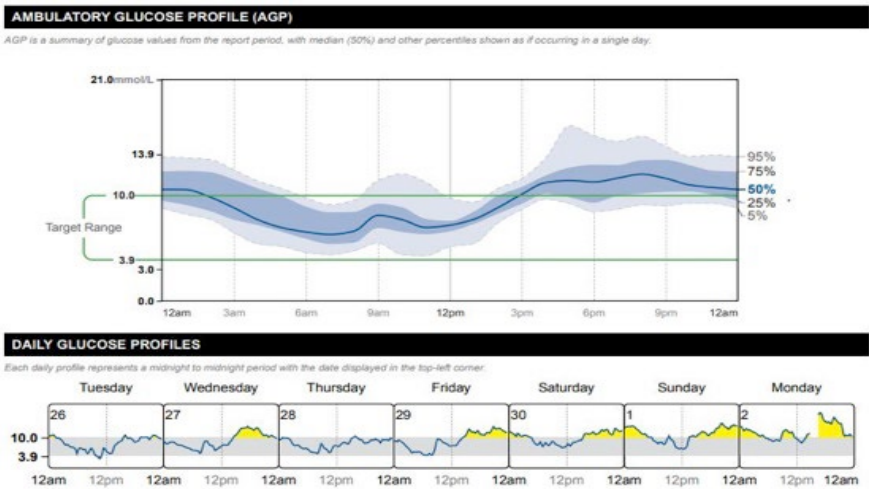


Fig 3 Trends and patterns are reviewed by the diabetes team remotely

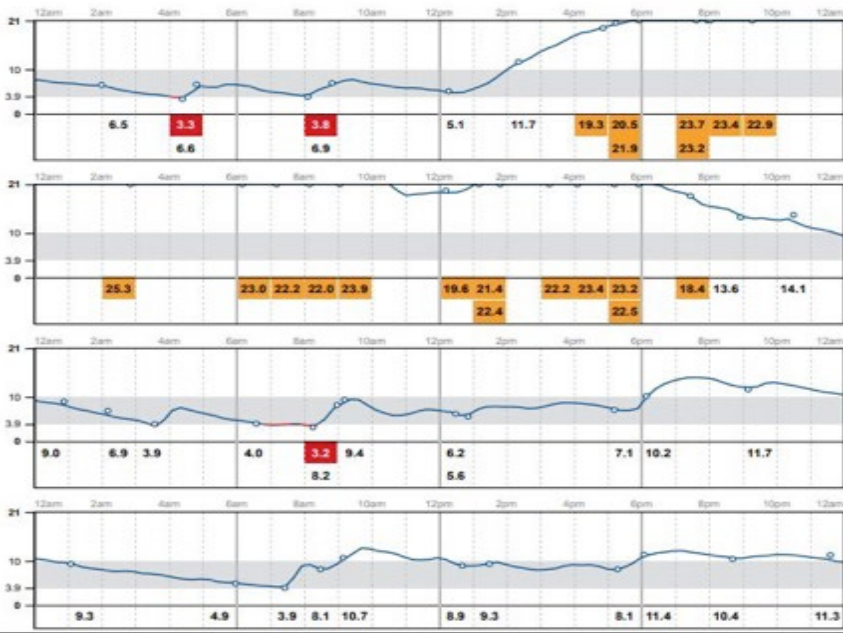


Fig 4 Sudden variations were identified when steroids commenced

Management of T1DM requires constant collaborating to provide well-coordinated care and enhance outcomes. Fig 4 Medications can quickly impact glucose levels and the need for prompt intervention is required. In regional areas where service delivery may not always be local, being able to review data remotely is advantageous.

FreeStyle Libre 2's alarm functions were Max's wife's greatest comfort. They alert users when their glucose levels are too high or too low. Trend arrows support the implementation of interventions to prevent adverse hypoglycaemic or hyperglycaemic events. Max's wife was able to retire to bed knowing that the alarm would wake her if necessary. She has been able to return to golf and gardening due to the ability to monitor Max remotely. It has given Max a sense of independence and freedom. He feels less burdened and more independent. Max's mood has brightened, his appetite has increased, and his quality of life has improved over the last three months.

Conclusion

Type 1 diabetes is a potentially life-threatening adverse event after the immunotherapy of cancers.

Older adults with type 1 diabetes are at high risk of hypoglycemia and need simplified insulin regimes. Max may be limited by his ability for self-management however he and his family have been empowered through working in partnership with his diabetes healthcare team. With the support of the multidisciplinary team and CGM technology Max is safely living at home. Not only can CGM technology assist with the reduction of adverse glycaemic events it can also improve quality of life for the person living with diabetes and their family. Max reports "we have the hang of it now," and his wife has quickly become the teacher, confidently explaining CGM to the visiting nursing student.

**Max - not his real name*

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Case seven

Anitha Ritchie

Role of Flash glucose monitoring in improving safety of older people living with diabetes

Introduction

Marko is a 75-year-old retired pensioner who migrated from Croatia to Australia at the age of 22 years old. Marko lives alone in his unit and has no immediate family in Australia. He was diagnosed with Latent Autoimmune Diabetes in Adult (LADA) in 1995 after a hospital presentation with hyperglycaemia and high ketone levels. Marko was referred to the Diabetes Educator by the Community Nursing (CN) Team in August 2021 to improve his diabetes management. At the time of referral, CN was visiting Marko twice daily to supervise insulin administration and blood glucose monitoring following a lengthy hospital admission in April 2021.

Assessment

Marko's discharge summary stated that he had 'a long and complicated stay including ICU admission and inpatient rehabilitation after presenting with rhabdomyolysis and significant Acute Kidney Injury requiring renal replacement therapy'. This was caused by a fall at home, and he lay on the floor for around 12 hours prior to getting help from a friend. Marko reported that he had had previous falls at home, he drank 1-2 bottle of wine every night and experienced worsening neuropathic symptoms. Excessive alcohol consumption is associated with increased hypoglycaemia related falls risk due to causing impaired cognition, worsening neuropathy, and preventing gluconeogenesis response to hypoglycaemia (1,4).

Past history:

- type 1 diabetes (LADA) since 1995
- hypoglycaemia (hypo) unawareness

- hypertension
- dyslipidaemia
- coronary artery disease (1999)
- ischemic heart disease (IHD)
- non-proliferative diabetic retinopathy
- ETOH dependence
- peripheral neuropathy
- ex-smoker

Management

Prior to this hospital admission, Marko had mostly phone consultations with Endocrinologist and GP due to COVID-19 restrictions. Marko's diabetes seemed well managed with HbA1c 6.8 % in Feb 2021 and other pathology results were within acceptable range for his age and he was up to date with all complication screening. Marko was on Levemir 44/35 units BD and Novorapid 18/18/28 units TDS. His morning insulin doses (Levemir 36 units and Novorapid 14 units) were reduced by the Endocrinologist due to some hypos occurring pre-lunch. There was also significant weight gain of 15 Kg (weight was 115 Kg) which was presumed to be caused by heart failure in the context of known IHD and this was managed by medications such as diuretic, Angiotensin-Converting enzyme inhibitor (ACEi) and beta blocker. Polypharmacy increases the risks of hypo in elderly due to medications such as beta blockers and ACEi can interfere with people's ability to detect adrenergic response causing hypo-unawareness.¹

The initial home visit gave me an insight into how Marko was managing his diabetes. Marko was on significantly lower doses of insulin at this stage (Levemir 21/31 units bd and Novorapid 15/12/10 units with meals) and his weight was 102 Kg. Although Marko has reduced his daily alcohol consumption to 1-2 glasses of wine, he was at risk of overnight hypoglycaemia. BG levels were checked before each meal, but we were unclear on how his levels were overnight. Marko was determined to improve the management of his blood glucose levels and prevent falls so he can feel safe at home.

Diabetes education was provided focusing on hypoglycaemia risks, prevention and management especially understanding the effect of alcohol on diabetes.

Lucidi et al² state that using sensor technology can assist people in improving their blood glucose management and help detect and prevent hypoglycaemia. After explaining the benefit of flash glucose monitoring on diabetes management, Marko agreed to complete the NDSS subsidy application for FreeStyle Libre which was approved within a week. I ordered him a FreeStyle Libre reader as Marko did not have a compatible phone and no internet. CN assisted with Libre sensor insertion, and I taught him how to scan using the reader, how to interpret sensor readings, and when to confirm levels using a finger prick. To our surprise, Marko was confident in checking his levels using the reader straight away and felt so happy that he can monitor his levels as often as he wanted without the pain.

After two weeks, FreeStyle Libre report showed Marko's glucose levels were dropping too quickly overnight and hypos are occurring early morning despite going to bed with levels above target range (refer Figure1). Marko had fear of hypo during the night and wanted his levels to be above 15.0 mmol/L prior to bed. After discussing these with his GP, Marko's insulin doses were reduced gradually to Levemir 21/21 units BD and Novorapid 15/10/10 units TDS with meals by GP. The second FreeStyle Libre report showed that lowering Levemir dose helped reducing overnight hypos and waking up with BG levels within target range for his age (refer figure 2).

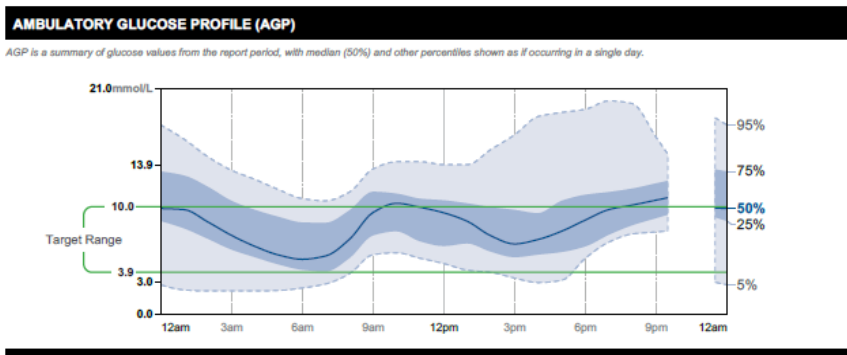


Figure1: Initial AGP report

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.

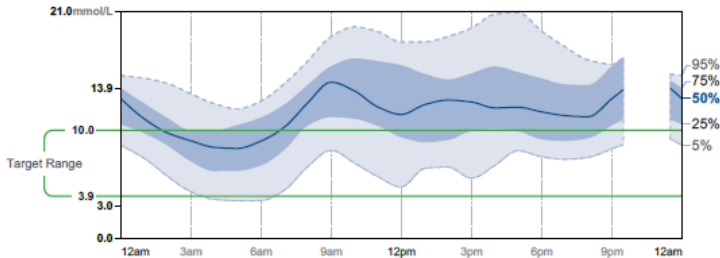


Figure2: Second AGP report after reducing insulin doses

Conclusion

Marko started feeling more confident in managing his diabetes. He experienced less glucose levels below target range and he gradually reduced CN visits to fortnightly for FreeStyle Libre sensor insertion. Individualised glycaemic targets are essential element of a treatment plan to reduce hypos in frail older people and those who have multiple risk factors such as hypo-awareness.² Although this has temporarily caused hyperglycaemia during the day, Marko was able to recognise some mild symptoms of hypo again. Marko did not experience any falls in the past 12 months and no emergency hospital presentations. Although Marko does not drive following the fall, he enjoys cooking, does weekly shopping and visits his friends at the local café. We have also learned that older people are socially isolated during pandemic and more vulnerable for deterioration in their physical and mental health.

A number of studies^{1,3} demonstrate significant associations between hypoglycaemia, microvascular complications, cardiovascular death and falls in older people living with type 1 diabetes. Therefore, it is important to establish an effective hypoglycaemia minimisation plan through structured education, individualised blood glucose target ranges combined with better glucose monitoring technology to assist reducing insulin doses in this vulnerable group.^{1,2} FreeStyle Libre played an important role in improving Marko's diabetes self-management and his quality of life by highlighting the

importance of lowering his insulin dose and providing education on how he can prevent hypoglycaemia.

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Case eight

Amy Rush

Adrenaline high but not glucose: A water skier finds liberation on Libre 2

Introduction

Lyn is a 43-year-old female with type 1 diabetes who is an avid water skier. She and her family compete in ski events, but this was not always the case. Type 1 diabetes doesn't mix well with water sports, and the Lyn's fear of hypoglycaemia has brought her close to giving up her passion.

At competitive levels, water skiing is an extreme sport demanding high level physical exertion. This creates an adrenaline rush, which, in people with type 1 diabetes, sends blood glucose levels (BGL) on a roller coaster of highs and lows.¹

When experiencing such significant variations, people with type 1 diabetes need to constantly monitor BGL. This is impossible when travelling over 100km/hr behind a boat or in the water, awaiting your next ski run.

In the past, Lyn managed by frequently stopping, returning to the boat, and completing a finger-prick test. However, this only provided snapshots of BGL. It showed pre-ski adrenaline-induced hyperglycaemia followed by exercise-induced hypoglycaemia. Avoiding hypoglycaemia was her priority, and she did this by reducing her basal insulin, omitting Novorapid and eating more carbohydrate before skiing – it was the only way she felt safe and confident to ski. While she longed to compete, she did not have the confidence in her BGL, nor did the competitions allow time to test and treat out of range BGL, so she was a spectator only on show days.

Assessment

When Lyn wore her first FreeStyle Libre in early 2016 and it changed her skiing forever. With the scanner in the boat, she could frequently signal for someone to lean out and scan her BGL. She finally felt safe and confident.

By mid-2016, she had joined a professional ski club, and by 2017 was competing interstate in national championships.

However, the FreeStyle Libre data showed her the full impact of adrenaline, reduced insulin, and frequent carbohydrate snacking on her hyperglycaemia. She knew this could not be her long-term strategy, so sought help from her CDE.

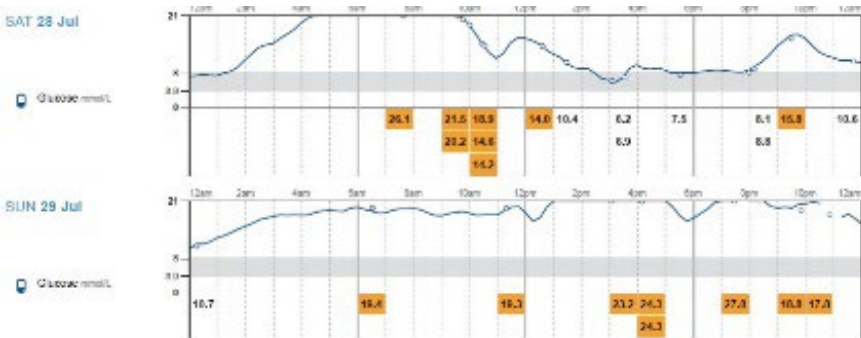


Figure 1: A typical water-skiing weekend BG profile

Lyn was determined to ski with a BGL closer to target, but fear of hypoglycaemia was hard to overcome. The initial goal was to reduce BGL to a range where she felt more comfortable without increasing hypoglycaemia. Working with her CDE, she developed a proactive, (rather than reactive) plan that included a significant reduction in morning Levemir combined with small, carefully timed Novorapid doses throughout the adrenaline surge. At regular intervals, she consumed small meals consisting of low glycaemic index carbohydrates, protein and fat. The post-ski plan included a decrease in evening Levemir and a reduction in the dinner bolus. She felt safer with the FreeStyle Libre, so she placed a waterproof bag containing the FreeStyle Libre

scanner inside her wetsuit. This allowed her to scan herself while in the water. She carried glucogel in case she needed treatment.

Management

Within three months, Lyn reported that the FreeStyle Libre data was teaching her a lot about her body's reaction to insulin, food, adrenaline, and exercise. Hyperglycaemic incidents had reduced significantly. We continued to consult LibreView reports to discuss alternative insulin and carbohydrate strategies as required. As she became more confident skiing with a BGL closer to target, overnight hypoglycaemia became an issue, as shown in Figures 2 and 3. Levemir titration seemed key, but despite ongoing trials and adjustments, we were unable to develop a plan that would work consistently.

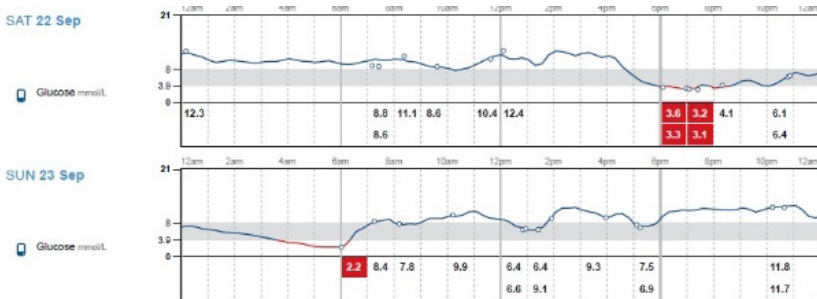


Figure 2: Overnight hypoglycaemia post ski-day

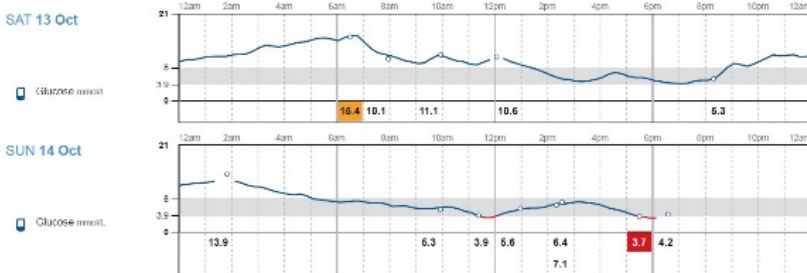


Figure 3: Overnight hypoglycaemia post ski-day

The release of FreeStyle Libre 2 was pivotal. Without a reader, she devised a workaround, keeping her phone in a waterproof bag under her wetsuit, which relayed BGL data to her waterproof Apple smartwatch. BGL monitoring became instantly easier. The low alerts allowed her to catch and treat hypoglycaemia quickly, in the water and overnight. However, we were determined to find a way to prevent it. The second breakthrough moment came with the release of the Omnipod insulin pump. We finally had a practical way to manipulate basal insulin while in the water.

Lyn began using the Omnipod in February 2022. With FreeStyle Libre 2 the transition was seamless. There is no ski-day plan these days, but preparations start hours before she hits the water. She scans BGL frequently, establishing trends, and adjusting or suspending basal rates as required. This process helps her manage the adrenaline-induced hyperglycaemia and reduce overnight hypoglycaemia. Extended bolusing is used to cover low glycaemic index meals, reducing post-meal hypoglycaemia.

With the FreeStyle Libre 2, she is scanning to predict BGL trajectory and titrates insulin accordingly. Figures 4 and 5 represent a typical ski weekend with the Omnipod and FreeStyle Libre 2, a match made in heaven.

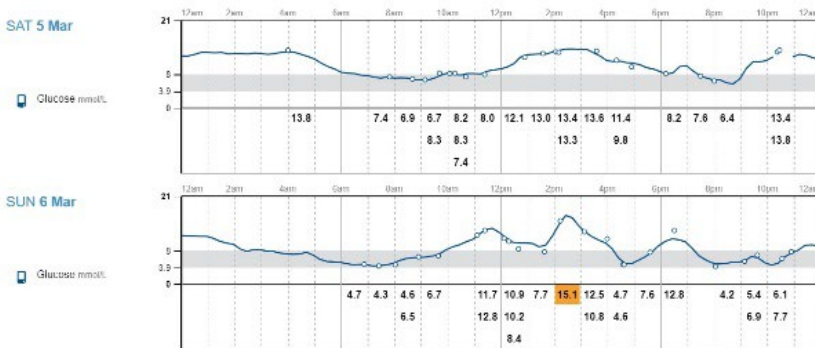


Figure 4: Ski-days with Libre 2 and Omnipod

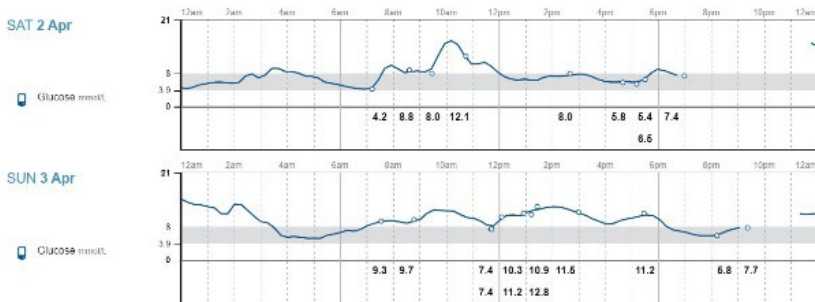


Figure 5: Ski-days with Libre 2 and Omnipod

Conclusion

In 'Life before Libre', Lyn spent ski days fearful of hypoglycaemia, and her BGL was forced well above 10mmol/L. Without the Libre, she may have given up here.

However, the ability to monitor BGL in the water, and using the FreeStyle Libre 2, which features alarms, has eased this fear. It has encouraged her to keep working towards BGL stability when water-skiing.

She now uses FreeStyle Libre 2 to determine BGL trends and adjusts Omnipod basal and bolus delivery accordingly. With this dynamic duo, she has a way to reduce hypoglycaemia incidence without compromising management of adrenaline-induced hyperglycaemia. She spends less time above target and keeps hypoglycaemic events to minimum. Her fear of hypoglycaemia has significantly reduced, positively impacting her emotional health.

Selected Dates: 17 Jul - 30 Jul 2021 (14 Days)

Time in Ranges

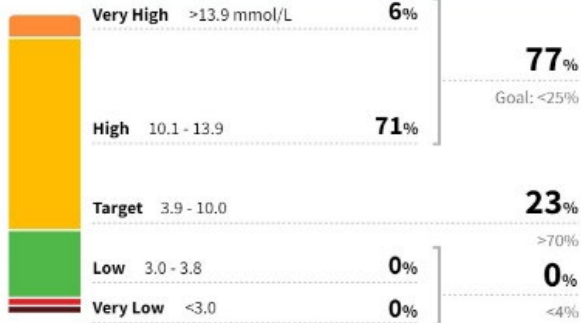


Figure 6: Life before Libre

Selected Dates: 12 Mar - 25 Mar 2022 (14 Days)

Time in Ranges

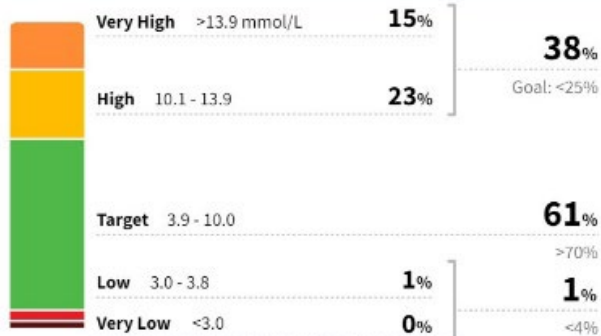


Figure 7: Life now

This FreeStyle Libre 2 journey will continue, as our clinical goals focus on fine-tuning basal rate changes and determining the optimal macronutrient composition of ski-day meals. Although Lyn has moved many hours' drive from clinic, LibreView allows us to connect via Telehealth and continue working together to achieve these goals. The FreeStyle Libre is the only glucose monitoring device conducive to water activity; for this water-loving person living with type 1 diabetes, FreeStyle Libre has been the answer. It keeps her physically safe, but more so has given her confidence to live life on the water, with no limits.

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Case nine

Katherine Snars

FreeStyle Libre 2 facilitates holistic care

Introduction

The client initially attended for his annual review with the Endocrinologist for his heavy vehicle licence medical certificate. This appointment was done via telehealth with the Endocrinologist in Brisbane, myself (CDE) at Roma and the client dialling in from another site. The client is a 54-year-old single male who has had type 2 diabetes for about 20 years. He lives in a small rural town with very few services and was working for the local council, often driving more than 300 km per day.

He had previously been seen by our service for his medical certificate but had not felt the need to engage regularly despite his HbA1c sometimes getting into the 9's. At this appointment in July 2021, we discovered that he had only been taking Metformin for the last month as he had run out of his other medications. His HbA1c was now 13.1% but of more concern was that his triglycerides were 37 mmol/L and cholesterol was 21 mmol/L.

Assessment

Due to his high triglycerides the Endocrinologist immediately organised to admit him to our hospital on an insulin infusion to get the triglycerides down and to recommence medications for diabetes, hypertension and hyperlipidaemia. Once levels stabilised, he was recommenced on Metformin XR 1g BD, Fenofibrate 145mg daily, Crestor 20mg daily, Fish oil 2g daily, Optisulin 25 units daily and Gliclazide MR 120mg daily. Other diabetes medications were not added at this time due to his high risk of pancreatitis. He was advised to monitor his BGL's regularly, to not smoke or drink and to only eat low fat, low carb meals.

While in hospital we discussed regularly checking his BGL's and he identified some issues including difficulty pricking his fingers because of the hardness of his skin, inability to clean his hands sufficiently while at work, forgetting to do it and just not wanting to do it. He was open to trying new technology and had a smart phone that was compatible with FreeStyle Libre. We were able to provide him with a sensor so that he could trial the FreeStyle Libre 2. While in the hospital he also saw the Dietitian, Exercise Physiologist and Nurse Practitioner (Chronic Disease) with follow-up organised.

Management

The client was discharged after six days in hospital. I saw him two weeks later when on an outreach visit to his nearest hospital. Figure 1 is the AGP report from the first download showing that his average glucose was 11.0 mmol/L and he was in range for 40% of the time. Over the next few months we titrated his insulin doses and worked with him on changing his diet and lifestyle. Insulin titration was done by following guidance from the Endocrinologist and contacting her when required. Initial review by the Endocrinologist was done at six weeks, then two to three month intervals. The dietitian and I met with him at least every two weeks initially with some phone calls in between. Once we had worked out plans going forward most of our contact was by phone due to the clients remoteness and work hours.

AGP Report

1 July 2021 - 14 July 2021 (14 Days)

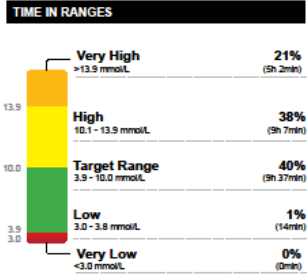
MIN: _____
 DEVICE: FreeStyle LibreLink +

SWHHS Diabetes
 PHONE: 0746242719

PAGE: 1 / 1
 Generated: 05/06/2022

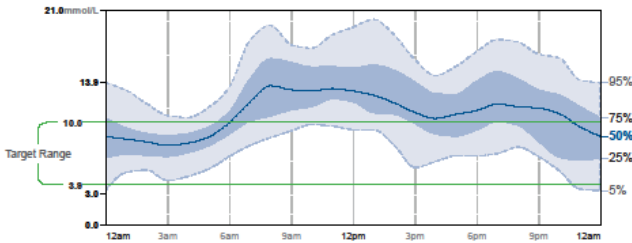
LibreView

GLUCOSE STATISTICS AND TARGETS	
1 July 2021 - 14 July 2021	
% Time Sensor is Active	95%
Ranges And Targets For Type 1 or Type 2 Diabetes	
Glucose Ranges	Targets % of Readings (Three 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% (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	11.0 mmol/L
Glucose Management Indicator (GMI)	8.0% or 64 mmol/mol
Glucose Variability	32.1%
Defined as percent coefficient of variation (NCV); target <36%	



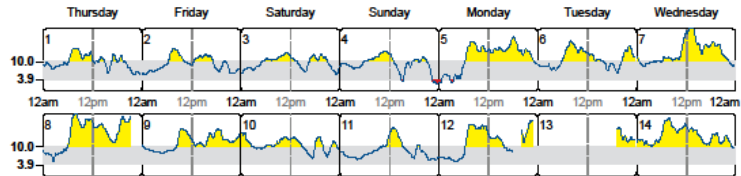
AMBULATORY GLUCOSE PROFILE (AGP)

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 top-left corner.



Source: Battelino, Tiedj, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American Diabetic Association, 7 June 2019, <https://doi.org/10.2337/dci19-0026>

Figure 1. AGP Report for two weeks to 5/7/21.

The dietitian worked with him to reduce his carbohydrate intake and his reliance on fast foods for morning tea and lunch. Some appointments have been jointly with the dietitian and myself. The client loved using the FreeStyle

Libre 2 and found that most of his issues with doing BGL's were resolved using FreeStyle Libre 2. He did not have to prick his finger and could check his BGL even if he had no way of cleaning his hands. He decided to continue using the FreeStyle Libre 2. Over time we were able to add Jardiance 25mg daily to his diabetes medications. In November his AGP was showing that his blood glucose levels were above target range during the day (Figure 2) and his average glucose and time in range were the same as in July. He was then commenced on Ozempic which has reduced fluctuations in BGL's and increased time in range.

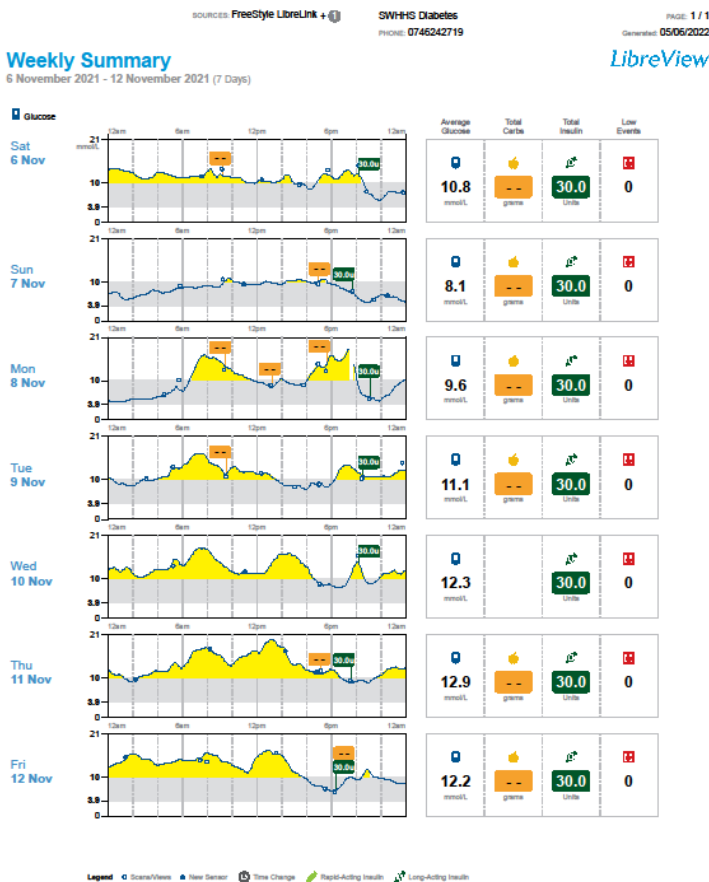


Figure 2. Weekly summary for 6-12th November 2021 showing fluctuations and high glucose levels.

Conclusion

The client using FreeStyle Libre 2 and being connected to LibreView with our practice has helped to improve his diabetes management. This has helped him overcome the barrier of distance and we are able to work together to help him manage his diabetes despite having more than 600km between the client and the Endocrinologist. The client felt that the hospitalisation with high triglycerides was 'the kick in the pants' he needed to make changes to his lifestyle. He has built rapport with the team and will contact us between appointments if he has concerns.

He loves using FreeStyle Libre 2 and initially decided to self-fund as this would mean that he would not have enough money to buy the alcohol and cigarettes he had to cease. Unfortunately, he had a heart attack (STEMI) in January and has heart failure. It is very unlikely that he will go back to his previous work but he is coping with this (and has been referred to appropriate services). His most recent HbA1c is 7.4%, cholesterol 3.4 mmol/L, eGFR >90 and no microalbuminuria. He has lost 25kg and continues to lose weight. His recent AGP for Libre 2 shows an average glucose of 8.0 mmol/L and 76% time in range (Figure 3) showing major improvement compared to Figure 1.

AGP Report

23 May 2022 - 5 June 2022 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

23 May 2022 - 5 June 2022

14 Days

% Time Sensor is 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

8.0 mmol/L

Glucose Management Indicator (GMI)

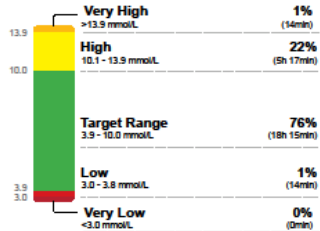
6.8% or 50 mmol/mol

Glucose Variability

29.8%

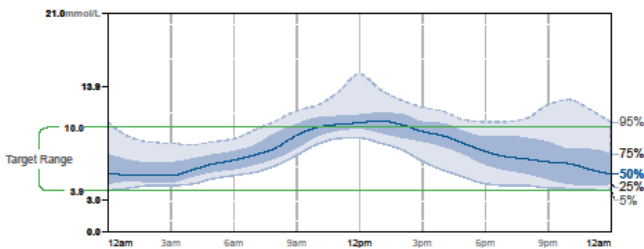
Defined as percent coefficient of variation (NCV); target <30%

TIME IN RANGES



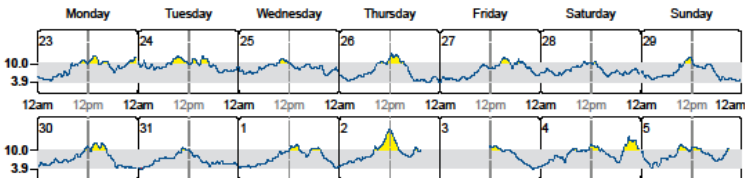
AMBULATORY GLUCOSE PROFILE (AGP)

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



DAILY GLUCOSE PROFILES

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



Source: Battelino, Tiedj, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American Diabetes Association, 7 June 2019, <https://doi.org/10.2337/doi19-0028>.

Figure 3. AGP Report for two weeks to 5/6/22 showing improved time in range and average glucose.

The way FreeStyle Libre 2 has been used in this case shows that it is not just about managing diabetes. This client had type 2 diabetes, hyperlipidaemia and

hypertension. Using FreeStyle Libre 2 has helped provide further motivation for ceasing smoking and drinking. The other potential barrier for this client was the application of the sensor as he was concerned with how fiddly it would be. By providing adequate education and demonstration he was confident with applying his sensor himself by the 3rd sensor. FreeStyle Libre 2 is a valuable tool when providing holistic, client-centred care to people with diabetes.

Case ten

Shona Vigus

FreeStyle Libre Flash glucose monitoring in someone living with Type 3C diabetes

Introduction

Type 3c Diabetes is caused by disruption to the structure or physiology of the pancreas such as through pancreatitis, pancreatectomy or pancreatic tumour.¹ This case study discusses the useful role of flash glucose monitoring in the management of Type 3c Diabetes where diabetes management sits alongside cancer treatment.

Ron* had been diagnosed with pancreatic cancer in 2020 on a background of type 2 diabetes not requiring medication. He was otherwise well and in the healthy weight range and had recently retired from a successful career in banking and finance.

A biliary stent was inserted, and chemotherapy was commenced shortly after the cancer diagnosis. After 24 chemotherapy rounds, there was sufficient reduction in tumour size and tumour markers to allow for Ron to have a 3 month break from treatment. Unfortunately, investigations in July 2021 showed that the tumour had metastasized to Ron's liver. A different chemotherapy was commenced, given with intravenous Dexamethasone. Ron began to notice polyuria and polydipsia for the first few days after each chemotherapy infusion.

Assessment

When Ron was admitted for revision of his biliary stent in October 2021, he was found to have a blood glucose level of 17.2mmol/L. A diagnosis of Type 3c Diabetes was made. Ron was prescribed Novomix 30 insulin with breakfast and referred to me for insulin education. He was now adding insulin-requiring

diabetes management to his already complex health journey. I offered Ron a FreeStyle Libre 2 trial.²

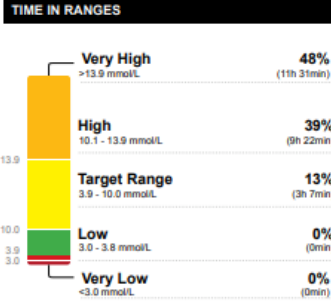
Ron's initial ambulatory glucose profile (AGP 1) was as follows:

AGP Report

20 October 2021 - 2 November 2021 (14 Days)

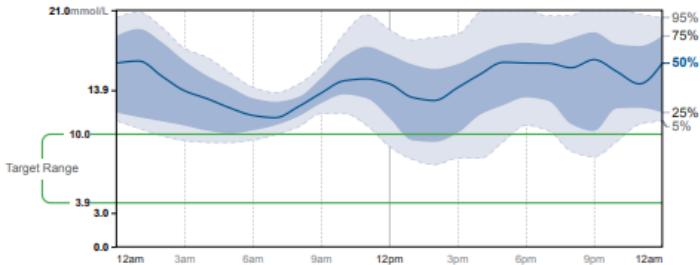
LibreView

GLUCOSE STATISTICS AND TARGETS	
20 October 2021 - 2 November 2021	
14 Days	
% Time Sensor is Active	88%
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	14.1 mmol/L
Glucose Management Indicator (GMI)	9.4% or 79 mmol/mol
Glucose Variability	24.7%
Defined as percent coefficient of variation (%CV); target <36%	



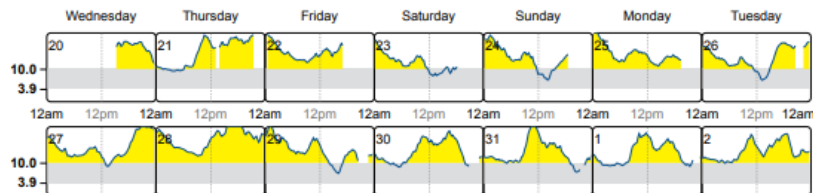
AMBULATORY GLUCOSE PROFILE (AGP)

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 top-left corner.



AGP 1

Ron's sensor glucose level was >10.0mmol/L for 87% of the time, with more than half of that >13.9mmol/L (see AGP 1).

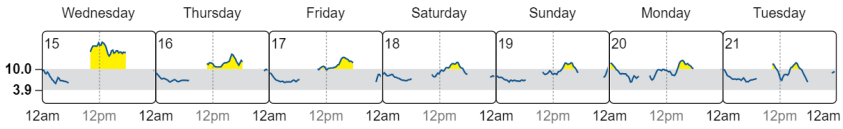
Ron wanted to improve his glucose management. Ron's oncologist suggested accepting a wide glucose target range, however, Ron was keen to avoid the hyperglycaemia symptoms that he had been experiencing. As Ron's diabetes educator, my role was to support Ron to achieve his goal, while minimising his burden.

It was agreed that Ron would add a small Novomix 30 insulin dose before his evening meal in addition to his breakfast dose. We settled on a glucose target range of 5-12mmol/L, with excursions up to 15mmol/L. Tight glycaemic control, while receiving chemotherapy with intravenous steroids was neither justified nor realistic on BD mixed insulin. It is well documented that corticosteroids induce a state of insulin resistance that causes hyperglycaemia in susceptible individuals,³ and this was another factor that would have to be navigated in Ron's diabetes management.

Management

After the initial FreeStyle Libre 2 trial, Ron reverted to capillary blood glucose monitoring. He had already been experiencing the emotional and psycho-social impact of his progression of cancer, as well as weekly chemotherapy and its side-effects, the most noticeable being "debilitating fatigue". To all of this he added insulin injections, learning about blood glucose targets, the impact of food and chemotherapy, insulin dose adjustments and now blood glucose monitoring. With some chemotherapy-related peripheral neuropathy developing in his hands, Ron found blood glucose monitoring frustrating and would often have to use multiple strips to obtain a result. He persevered for six weeks before purchasing a FreeStyle Libre 2 sensor and reverting to flash glucose monitoring. Ron was not interested in 'capturing all the data'; he used the FreeStyle Libre 2 according to his own needs, generally scanning only two or three times each day.

Ron was having a very predictable rise in his sensor glucose levels with each chemotherapy cycle, related to receiving intravenous Dexamethasone, as seen in the daily glucose profile (see AGP 2 portion).



AGP 2 portion

Dexamethasone is a long-acting corticosteroid, with a hyperglycaemic effect extending beyond 24 hours.⁴ Using the FreeStyle Libre 2 data, we were able to develop a plan for variable insulin doses according to Ron's weekly chemotherapy cycle, with higher insulin doses on 'chemo day' tapering over the subsequent two days. Ron's goal of achieving good glycaemic control was met with almost no episodes of hypoglycaemia.

Ron's most recent AGP is as follows:

GLUCOSE STATISTICS AND TARGETS

17 May 2022 - 30 May 2022 14 Days
 % Time Sensor is Active 71%

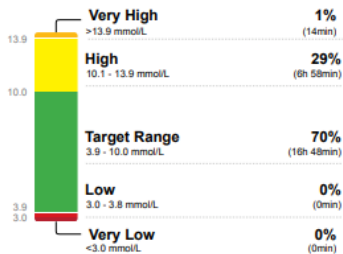
Ranges And Targets For Type 1 or Type 2 Diabetes

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.

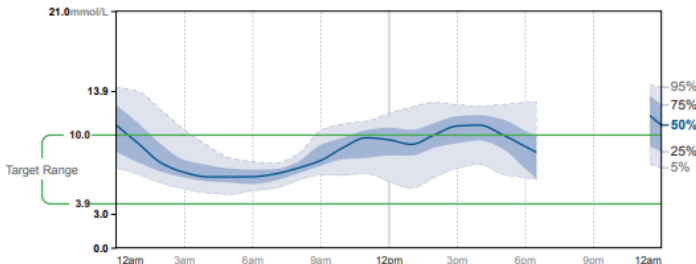
Average Glucose 8.5 mmol/L
Glucose Management Indicator (GMI) -
Glucose Variability 26.7%
 Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



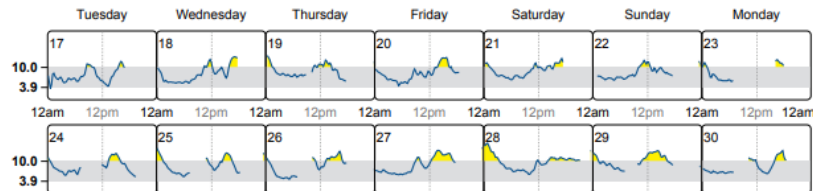
AMBULATORY GLUCOSE PROFILE (AGP)

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



DAILY GLUCOSE PROFILES

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



AGP 3

Ron now scans his FreeStyle Libre 2 sensor twice a day, occasionally more. He injects Novomix 30 insulin twice a day according to his weekly plan and eats sensibly. He no longer experiences polyuria or polydipsia with his chemotherapy and describes having more energy than previously. His diabetes management burden is minimised while achieving a level of glycaemic control

that avoids both hyperglycaemia symptoms and hypoglycaemia (see AGP 3), allowing him to maximise his quality of life.

Conclusion

Over the last four months Ron has made adjustments to his Novomix 30 insulin doses from time to time, in discussion with me, usually via email. His FreeStyle Libre 2 account is linked to our clinic LibreView account, so I can login and see his reports and compare the data to Ron's email. If he experiences hypoglycaemia, he reduces his insulin doses. He has learned how to make logical insulin adjustment decisions from observing his data and generally, Ron emails the question "I'm thinking of making this change, what do you think?" and I check his plan and occasionally point out something he might not have considered. He has grown in confidence in managing his Type 3c Diabetes while not allowing it to absorb more of his time or mental space than it should. The improvements in his AGP are largely attributable to Ron's logical mind and sensible approach.

I have been reflecting on what it means to work with clients towards their individual goals, and what it means to give them the support that is needed without overwhelming them with unnecessary tasks, goals, information or even contact.

The goal has been for Ron to live life how he chooses, recognising the limitations posed by his cancer treatment but not adding an unnecessarily large burden from intensive diabetes management. Ron aims for tighter glucose control than his oncologist suggested, but a more relaxed target range than some people with diabetes aim for. Working with Ron has confirmed to me the importance of allowing the person with diabetes to set the agenda and decide on the goals of their diabetes management.

**Individual has been deidentified for the purpose of confidentiality*

References

1. Aberer F, Hochfellner DA, Sourij H, Mader JK. A Practical Guide for the Management of Steroid Induced Hyperglycaemia in the Hospital. *Journal of Clinical Medicine* [Internet]. 2021 May 16;10(10):2154. Available from: <http://dx.doi.org/10.3390/jcm10102154>
2. <https://www.freestylelibre.com.au/>
3. Longaker, L., Clements, J. N. Evidence-Based Management of Steroid-Induced Hyperglycemia in the Inpatient Setting. *ADCES in Practice*. 2022; 10(1), 40–45. Available from: <https://doi.org/10.1177/2633559X211056902>
4. Chris Woodmansey, Andrew P. McGovern, Katherine A. McCullough, Martin B. Whyte, Neil M. Munro, Ana C. Correa, Piers A.C. Gatenby, Simon A. Jones, Simon de Lusignan; Incidence, Demographics, and Clinical Characteristics of Diabetes of the Exocrine Pancreas (Type 3c): A Retrospective Cohort Study. *Diabetes Care* 1 November 2017; 40 (11): 1486–1493. <https://doi.org/10.2337/dc17-0542>

Notes



2023 *FreeStyle living with diabetes: Learning from case studies* competition

Submissions will be open in February 2023, with the *FreeStyle living with diabetes: Learning from case studies* competition session for the People's Choice Award held at the Australasian Diabetes Congress 2023.