

# Abbott Case Study Competition 2021



Your trusted partner in diabetes care

# Acknowledgement

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

- Ann Bush, ADEA Board Member
- Karen Crawford, Chair of ADEA Course Accreditation and Standards of Practice
- Rachel Freeman, ADEA Professional Services Manager
- Dr Sue-Lynn Lau, Endocrinologist at Westmead Hospital
- Peta Tauchmann, Chair of the ADEA Clinical Practice Committee
- Robert Steadman, Consumer representative

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.

The Abbott Case Study Competition 2021 is financially supported by Abbott Diabetes Care.



## Disclaimer

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

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# About ADEA

The Australian Diabetes Educators Association 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 2,250 members, there are over 1,500 Credentialed Diabetes Educators (CDEs) in Australia. These specialists in diabetes education, management and care support 1.3 million people diagnosed with diabetes and registered on the National Diabetes Services Scheme (NDSS), and a further 500,000 people with silent, undiagnosed type 2 diabetes.

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 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 Diabetes Care

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, 103,000 Abbott employees are working to help people live not just longer, but better, in more than 160 countries that we serve.

## Abbott Case Study Competition 2021

The 2021 Abbott Case Study Competition 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 Monitoring and ambulatory glucose profile.

Submitted case studies included principles of person-centred care and were encouraged to adhere to the Diabetes Australia Language Position Statement while discussing the use of Flash Glucose Monitoring<sup>1</sup> with, or without, ambulatory glucose profile<sup>2</sup> and 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 to increase time in range.

The top nine case studies are featured in this booklet. Each submission was assessed by all members of the panel of judges in a blinded review process. The top five entries were then selected to present at the Australasian Diabetes Congress 2021 (ADC). The winner of the Abbott Case Study Competition 2021 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 8 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

**Michelle Booth**

***Brilliant, just give it a swipe and there you go***

## Introduction

Richard\* is an 86-year-old pensioner with diabetes (diagnosis unspecified) living alone in a rural retirement village.

At initial presentation to the diabetes service, his insulin prescribed comprised of 84 units of Humulin NPH (intermediate-acting) insulin pre-breakfast and 24 units Humulin NPH insulin pre-bed. He reported checking blood glucose levels three times per day, prior to meals. His understanding of diabetes management was limited. He reported frequently waking up with a low blood glucose level (BGL) of 2.0 mmol/L. Not recognising this as a hypoglycaemic event Richard reported thinking that he needed more insulin at this point and would immediately administer his morning insulin.

Richard also described instances of impairment with memory. One example given was finding he had driven his car around town yet having no recollection of how he got there. He also described an instance of having turned his otherwise neat and tidy home upside down. His neighbour found him and provided assistance but he had no recollection of the event afterwards. He also described frequent night sweats alongside frequent lethargy during the day. Richard attributed these signs and symptoms to general ageing and had not shared this information with his treating clinicians, a local General Practitioner (GP) and a Physician.

\*Name changed for confidentiality

## Assessment

Richard initially presented to the diabetes service without an appointment or a referral from his GP or Physician. He requested to see the Credentialed Diabetes Educator (CDE) for advice regarding his diabetes management.

He was assessed by the CDE and it was determined that the signs and symptoms he had attributed to general ageing were consistent with frequent hypoglycaemic events<sup>1,2</sup>. He displayed signs of being hypo unaware and it was considered likely that his treating GP and Physician were unaware of these frequent hypo events.

There was an identified need for regular contact by the CDE to educate Richard on diabetes management, including hypoglycaemia, to raise his hypo awareness and to ensure appropriate treatment when hypos occurred<sup>3,4</sup>. The excessive insulin load on board (108 units total per day) was identified as a cause of the frequent hypoglycaemic events<sup>5</sup>. Insulin titration needed urgent attention to optimise insulin use to reduce hypoglycaemia.

### Management

Richard was started on Flash Glucose Monitoring to obtain an accurate picture of daily BGL fluctuations to facilitate appropriate clinical decision making with regards to safe insulin titration and also to assist with educating him about diabetes management. As a result of the data obtained from the use of the Flash Glucose Monitoring he was changed from twice daily intermediate acting insulin to once per day mixed insulin (Ryzodeg 70/30).

Following insulin titration, Richard has decreased his insulin stepwise from a total daily dose of 108 units of intermediate acting insulin to a single daily dose of 25 units of Degludec/Insulin Aspart 70/30 prior to breakfast. Flash Glucose Monitoring data shows readings in target range 84% of the time, high at 15%, and in the low or very low range 0% of the time 12 months after the initial consult (Figure 1). Current HbA1c is 7.2%.

# AGP Report

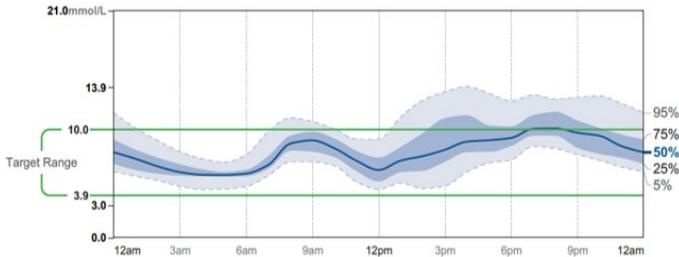
5 May 2021 - 18 May 2021 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS		TIME IN RANGES																								
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<b>Average Glucose</b>	<b>7.9 mmol/L</b>																									
<b>Glucose Management Indicator (GMI)</b>	<b>6.7% or 50 mmol/mol</b>																									
<b>Glucose Variability</b>	<b>27.8%</b>																									
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## AMBULATORY GLUCOSE PROFILE (AGP)

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



## DAILY GLUCOSE PROFILES

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

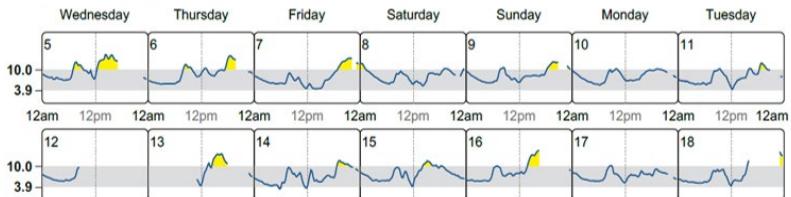


Figure 1

Richard described the simplicity of Flash Glucose Monitoring as facilitating his diabetes management: *“brilliant, just give it a swipe and there you go”*. This has led to him *“watching it more now”* because it is so simple to check in on his BGLs with the flash monitoring system.

## Conclusion

Richard's hypo awareness has improved along with his prevention and management of hypo events. His knowledge of diabetes management has increased, greatly aided by viewing and discussing data obtained from the Freestyle Libre receiver at each CDE consult. Richard is proactively asking questions of the clinical team about his diabetes management and is directing his own care through suggesting his own adjustments to the insulin; so much has his confidence and knowledge improved:

The reduction in hypo events and overall optimisation of insulin treatment has had a positive impact on Richard's lifestyle. His lethargy has ceased and he is now engaging in regular exercise through walking in his garden and around the neighbourhood. He also describes being more proactive in his dietary choices. Richard described previously feeling like "I was finished" and "in no man's land" and now he describes being "ready to go" with engaging in life and his diabetes management.

This case study highlights the importance of the clinical team asking specific questions around hypo symptoms in older people living with diabetes to ensure that these symptoms are not just being brushed off as a general side effect of ageing.

Flash Glucose Monitoring proved itself a valuable tool in educating this older person about diabetes management demonstrating that older people living with diabetes can be engaged with new technologies for their diabetes management and such technologies can support their diabetes education. You can indeed teach an "old dog" new tricks about diabetes.

## References

1. Freeman J. Management of hypoglycemia in older adults with type 2 diabetes. *Postgrad Med.* 2019 May;131(4):241-250. doi: 10.1080/00325481.2019.1578590.
2. Hope SV, Taylor PJ, Shields BM, Hattersley AT, Hamilton W. Are we missing hypoglycaemia? Elderly patients with insulin-treated diabetes present to primary care frequently with non-specific symptoms associated with hypoglycaemia. *Prim Care Diabetes.* 2018 Apr;12(2):139-146. doi: 10.1016/j.pcd.2017.08.004.
3. Mutch WJ, Dingwall-Fordyce I. Is it a hypo? Knowledge of the symptoms of hypoglycaemia in elderly diabetic patients. *Diabetic Medicine.* 1985 Jan;2(1):54-6.
4. Jaap AJ, Jones GC, McCrimmon RJ, Deary IJ, Frier BM. Perceived symptoms of hypoglycaemia in elderly type 2 diabetic patients treated with insulin. *Diabetic Medicine.* 1998 May;15(5):398-401.
5. Kalra S, Mukherjee JJ, Venkataraman S, Bantwal G, Shaikh S, Saboo B, Das AK, Ramachandran A. Hypoglycemia: The neglected complication. *Indian J Endocrinol Metab.* 2013 Sep;17(5):819-34. doi: 10.4103/2230-8210.117219.

## Acknowledgement

Thanks to Dr Jannine Bailey, Bathurst Rural Clinical School, Western Sydney University who interviewed the person for this case study

# Case two

Amy Burrowes

## ***Diabetes Back on Track – Use of Flash Glucose monitoring in an indigenous community***

### Introduction

During 2020's COVID lockdown the ACCHO that I work at received funding to look at ways that technology could improve the provided during lockdown.

I suggested that we look at using Flash Glucose Monitoring – Libre and mobile phone devices so we can see their diabetes management from home on Libre View.

We offered this trial to Indigenous clients that had Type 2 DM on insulin over a 6-month period. The clients recruited ranged in age from 30-85 years of any gender. They were a mixture of employed, un-employed and retired. Their socio-economic status also varied.

We had the opportunity to take baseline measures of Hba1c, anthropometry, BGM trends and medications. This way we could look at the quantitative changes over the 6 months.

We also looked at qualitative measures as to the burden of disease and if their management improved. The trial had the help of GP's, Nursing Staff, Aboriginal Health Workers and myself (CDE/APD).

### Assessment

Six clients took part in the 6 month trial and were funded with Libre sensors for that time and a device.

These six were all on different insulin regimes: basal or basal bolus +/- oral agents.

Prior to the trial most were sporadically BGM but not enough to see patterns.

Point of care Hba1c were available and these six had them done regularly.

Main issues at the initial assessment with each client were as follows:

- Lack of awareness into their BGL and what affects them
- Reduced BGM secondary to burden of disease
- GP's relying on Hba1c to make adjustments
- Poor self-management techniques
- Lack of awareness into insulin's affect

We decided to use Libre as this population group had not been exposed to it before. Change is a big thing, so we had to work slowly and clearly.

Having used it in a Non-Aboriginal and Torres Strait Islander population I saw the improvement in self-management and care for their diabetes. I was hoping to see that in this population.

In addition, it meant I was able to assess their diabetes easier during the pandemic via Libre View.

## Management

Diabetes management changes:

- Patients checking BGL more often, but still not 100% active time.
- Patients more hypo aware now – resulting in less hypos occurring.
- All participants managed the technology without difficulty.
- Patients reported more interest in their management as they didn't need to finger prick up to four times per day.

Goals: improve diabetes management and their ability to self-manage.

*Issues/obstacles:*

- Some phones not compatible so required the reader and then the patient to attend for download.

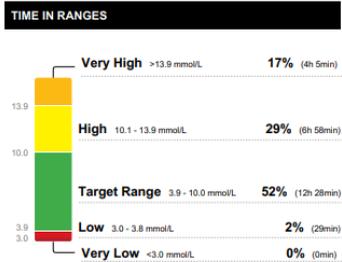
- Other staff not confident in downloading and reading Libre View at the start. With further education and summary sheets, all staff are confident in this platform.
- ED departments not being aware of the technology when patients present. Therefore, not able to see data.
- Other patients that commenced the trial but failed to use appropriately over the trial period, therefore excluded from the study.

## AGP Report

16 April 2021 - 29 April 2021 (14 Days)

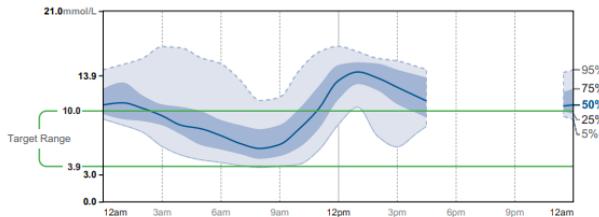
LibreView

GLUCOSE STATISTICS AND TARGETS	
16 April 2021 - 29 April 2021	
14 Days	
% Time Sensor is Active	57%
Ranges And Targets For Type 1 or Type 2 Diabetes	
<b>Glucose Ranges</b>	<b>Targets % of Readings (Time/Day)</b>
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.	
<b>Average Glucose</b>	9.8 mmol/L
<b>Glucose Management Indicator (GMI)</b>	-
<b>Glucose Variability</b>	36.1%
Defined as percent coefficient of variation (%CV); target ≤36%	



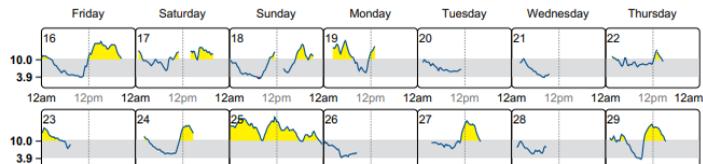
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AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



## DAILY GLUCOSE PROFILES

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



Source: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American Diabetes Association, 7 June 2019. <https://doi.org/10.2337/doi:19-0028>.

Time in range:

- Educating on eliminating hypos first. Addressing the potential cause of them. Now all participants experience less.
- Educating on target ranges and what to do when levels are outside. Most required support with dietary intake.
- Education on reviewing the daily time in range and adjusting insulin doses accordingly or seeking help.

### Conclusion

In our small cohort, the use of Libre for people living with diabetes allowed them to have a new sense of care about their diabetes.

The use of Libre made self-management easier and less of a burden. All of the participants said they were more interested in their BGL's and ways to improve them.

Prior to this technology most rarely checked their BGL or understood the benefit of knowing the patterns.

Most of the participants are on support packages that have agreed to continue funding the Libre after our trial.

At the commencement of the trial all participants were excited as it meant no finger pricking. Once Libre started, they saw how easy it was to use, and the amount of information that clinicians gain from them scanning.

We found over the 6 months that patients were scanning more often but still not enough to get 100% active time. These gaps in data make it difficult for us to see the whole picture but it is still more than we previously gained from occasional BGL's and Hba1c.

For all the participants we had to alter insulin doses. This was because hypos were evident. One participant even had his insulin ceased for a period due to optimal control.

Diet is still a huge factor in this population group as to why BGL are not in target more often. Addressing this is a regular part of all assessments, as well as discussing exercise.

Clinical measures were reviewed and our small population group saw a reduction in Hba1c across the board. We did not see any change in their weights from baseline or blood pressure.

The biggest result seen was how they didn't feel the burden of diabetes. They all reported when they had to BGM that they didn't enjoy the experience and wouldn't check regularly.

One area we still need to work on is ways to educate those living with diabetes about how to achieve more time in range. Changing lifestyle choices that may have been done for some time isn't always easy, so small steps to educate are needed.

If I were able to be at this workplace more often to see people and provide education to staff and the people living with diabetes this would be better.

GP's have a large role here too in reminding patients of why these targets are important. GP's started to look at the downloaded reports and made adjustments to management based on these. I feel if they were to wear the Libre sensors, it would improve their understanding further.

At present Libre is only for people on insulin but in the Aboriginal and Torres Strait Islander community, the benefit that Libre has is so important. It can mean delayed need for insulin management and improved health outcomes before complications. All people with diabetes can benefit from this technology as it can make managing the condition easier.

# Case three

## Maria Constantino

### ***So you want me to stop insulin?! How Freestyle Libre can assist precision medicine***

#### Introduction

Mrs CO is a 62-year-old disability worker, married with one daughter.

Type 2 diabetes was diagnosed at aged 38 years

BMI 29 kg/m<sup>2</sup>

Family history includes: mother, maternal grandmother and great grandmother with “supposed” type 1 diabetes on insulin therapy two brothers with ? type of diabetes and her daughter treated for type 1 diabetes since age 16.

Slim phenotype noted in 2012 – negative for GAD and ICA antibodies  
Treated with Lantus, Gliclazide MR 120mg mane, Metformin 1 gm BD  
Commented at the time that she had to eat to avoid recurrent hypoglycaemia

Maintained on this regimen until 2017

New medication regimen Lantus and Xigduo and then Ryzodeg and Xigduo

HbA1c between 2012 and 2021 ranged from 7.5% and 9.5% despite best efforts

Medical history included coronary disease requiring stenting twice, hypertension, dyslipidaemia and sleep apnoea

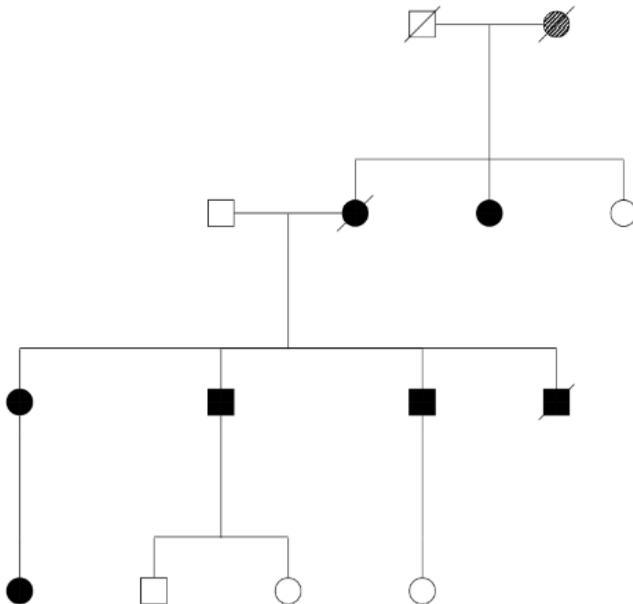
## Assessment

The significant autosomal dominant family history on the mother's side going back at least two generations, the absence of pancreatic islet antibodies amongst other clues alerted our team to the possibility of monogenic diabetes MODY (not type 1 or type 2 diabetes).

CO was assessed in our multidisciplinary Atypical Diabetes Clinic at RPA Diabetes Centre and underwent genetic testing and a genetic diagnosis of **maturity onset diabetes of the young, subtype HNF1A** was confirmed.

This led to a significant rethink of her treatment regimen

The literature indicates that HNF1A can be treated with sulphonylurea therapy in the first instance and **potential discontinuation of insulin** <sup>(1,2)</sup>



## Management

Together with CO, it was decided to undertake a trial off insulin. Ryzodeg 30 units mane was ceased and she was commenced on Gliclazide 40 mg mane + Xigduo.

Both patient and clinicians were very anxious, this is a rarer diabetes subtype (~1% diabetes) and clinical experience is limited.

For safety reasons during this transition she would have required BGM at least 6 tests during the day and one or two overnight. She was reluctant to perform more than 2 tests per day.

Flash Libre was applied to enable her 24 hour glucose profile to be assessed.

Flash Libre showed glucose levels within the normal range generally but with elevated glucose post dinner due to high CHO intake with dinner. Gliclazide 40mg before dinner was added as targeted therapy and she was counselled about carbohydrate portion sizes.

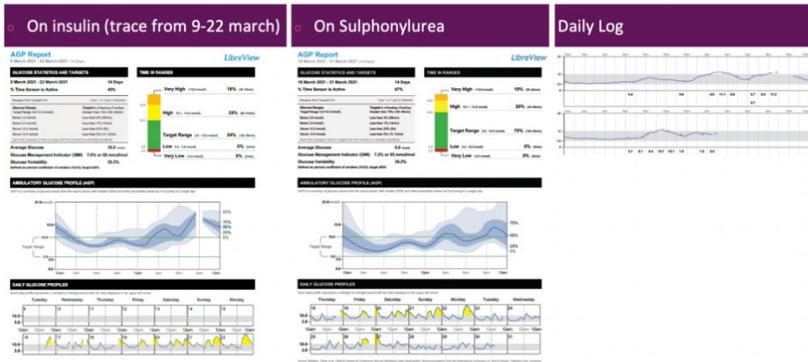
Flash monitoring showed no hypoglycaemia and CO remarked that she felt no side effects and seeing her constant glucose profile was very reassuring.

Tracking CO's glucose levels in real time via the LibreView website allowed us to contact her regularly by phone and email. Furthermore, she was grateful that she did not miss any work days.

Seeing her glucose levels at any time without finger pricking has been life changing for CO and she is making better food choices. She now truly understands for the first time the impact of food and exercise and lifestyle on her glucose levels and has modified her behaviour accordingly. This has improved her TIR.

Three months post the diagnosis of MODY and significant change in treatment, the ambulatory glucose profile showed TIR 70%, no hypoglycaemia, variability 35.6% and GMI 7.3%

She continues to manage without insulin with much improved glycaemic control. TIR improved from 54% to 70% off insulin without hypoglycaemia .



## Conclusion

We present a very interesting case of a person found to have HNF1A MODY, a rare type of diabetes, very sensitive to sulphonylurea therapy. She had been diagnosed with type 2 diabetes 24 years ago and thought to require lifelong insulin therapy. With the help of Flash Monitoring, supporting her and her healthcare team, she was successfully transitioned off insulin on to sulphonylurea treatment. She has an improved TIR without hypoglycaemia.

Client's outcomes (clinical or non-clinical) improved with this technology?

- Managed off insulin! Without hypos
- TIR improved over a short time (3)
- GMI at target
- Despite having diabetes for 24 years, Flash Libre truly helped her to understand the impact of certain behaviours on her glucose levels and to modify these. The technology used to make a difference to a client's quality of life.

CO struggles with the new diagnosis finding it difficult to explain after 24 years of insulin therapy that she is not currently on insulin therapy and doing well.

Flash Libre has reassured her and made her feel safe. In addition, she stated how she finally understood how some foods and other behaviours affect her glucose levels.

A dearth of literature on HNF1A exists and flash glucose monitoring made it possible to support CO in her treatment transition from insulin to sulfonylurea in a safe manner.

Ms CO was very nervous about ceasing insulin. We were nervous! Flash Libre helped calm all our anxieties.

She no longer takes insulin and is delighted by this!

The technology changed practice for the diabetes team. Technology has provided new clinical information on a rare type of diabetes not commonly recognised in clinical practice. It adds to the scientific literature to support the transition off insulin for this type of diabetes. The technology gave the treating team the confidence to make this dramatic change to treatment.

Technology contributed to the avoidance of an adverse event. It allowed the transition from insulin to oral therapy with the confidence that we could avoid hypoglycaemia or hyperglycaemia and apply rescue therapy as necessary.

There were no significant challenges to the client using this technology.

CO did not find any challenges using this technology. Encouragement from the team stimulated more frequent scanning. She found biofeed back from the technology reassuring.

Time in range was improved by applying the principles of personalised medicine

By matching the genomic diagnosis of diabetes with the most appropriate treatment, her treatment was personalised and for the first time in 24 years of diabetes she achieved improved TIR

## References

1. Pearson, E.R., Liddell, W.G., Shepherd, M., Corral, R.J. and Hattersley, A.T., 2000. Sensitivity to sulphonylureas in patients with hepatocyte nuclear factor-1 $\alpha$  gene mutations: evidence for pharmacogenetics in diabetes. *Diabetic medicine*, 17(7), pp.543-545.
2. Valkovicova T, Skopkova M, Stanik J, Gasperikova D. Novel insights into genetics and clinics of the HNF1A-MODY. *Endocrine regulations*. 2019 Apr 1;53(2):110-34.
3. Battelino T, Danne T, Bergenstal RM, Amiel SA, Beck R, Biester T, Bosi E, Buckingham BA, Cefalu WT, Close KL, Cobelli C. Clinical targets for continuous glucose monitoring data interpretation: recommendations from the international consensus on time in range. *Diabetes care*. 2019 Aug 1;42(8):1593-603.

# Case four

## Carmen Holmes

### *Flash Out Loud*

#### Introduction

A 41 year old male who was diagnosed with type 1 diabetes when aged 16 years, attended our diabetes service to help him resolve problems and technical difficulties with his subsidised continuous glucose monitoring (CGM) device and Medtronic 670G insulin pump, with a view to commence using auto mode on his pump. Testing and reading his blood glucose level (BGL), putting BGL onto his pump, inserting sensors, connecting his CGM to his pump, calibration and responding to alarms, were all problematic for him as he is legally blind, largely due to Wolfram syndrome. This led to overall frustration with the devices and his diabetes care in general.

His medical history includes Wolfram syndrome, oesophageal dysmotility, polyneuropathy, autonomic neuropathy with postural hypotension, neurogenic bladder and diabetes neuropathy requiring regular injections. He also has proteinuria with no current treatment options, due to postural hypotension. Despite his vision impairment, he likes to go out regularly for social interaction and physical activity and he is a carer for his father who has multiple medical conditions.

#### Assessment

On assessment, it was obvious that the CGM device he was currently using was not the best option for him, as he only lasted a few days using it due to the above issues. He tried again and again, but each time only persisted for a few hours before giving up in total frustration.

After re-assessing the options available to him to solve his issues, a joint decision was made to apply for a Freestyle Libre. The justification for selecting the flash monitoring device was:  
relatively easy insertion procedure - is only a two-step process

minimal requirement for calibration - it is factory calibrated and only needs peripheral blood glucose testing if symptoms do not match the scanned BGL.

Audio option - when he scans, a phone app voices his BGL can be connected to a clinic account for easy access/review by health care professionals.

## Management

As soon as the Freestyle Libre was approved, training commenced. He had no issues inserting the device. One challenge that remained however, was needing to put his BGL into his pump, but using a magnifying glass solved this. He was confident using the device in no time, reporting his quality of life was much improved with no worries regarding insertions, calibrations and alarms. He reported “even blind can use it”. He was able to focus on how he could improve his diabetes management and was comfortable knowing he could contact our service when he needed help.

A few months later, he did contact our service again, due to hypoglycaemia and weight loss concerns. The multidisciplinary team comprising a Credentialed Diabetes Educator, Dietitian and Diabetes Specialist investigated his weight loss, reviewed insulin rate adjustments and Time in Range (TIR) utilising Libre View reports, and made suggestions for healthy eating and prevention of hypoglycaemia.

His Libre View report (Figure 1), indicated he was not pre-bolusing. Pre-bolusing was daunting for him, due to loss of appetite and often being unable to consume all of his meals, possibly causing hypoglycaemia. He agreed to pre-bolus part of his insulin dose and deliver the remainder later. However, he was unable to use the different bolus features due to his sight limitations. He also revealed he would drink a large hot chocolate before bed without bolusing, for fear of hypoglycaemia overnight, hence causing hyperglycaemia.

Ongoing reviews with the Credentialed Diabetes Educator and Dietitian occurred. The last review showed a slight decline in TIR, but improved glucose variability with minimal hypoglycaemia episodes, which had reduced from 23 down to 1 over a six month period (See Figure 2). Adjustments were made to his basal dose as well as an increase in his

lunchtime insulin to carbohydrate ratio to help with post prandial rise.

Figure 1 – sample of his Freestyle Libre report in LibreView, with hypoglycaemia episodes

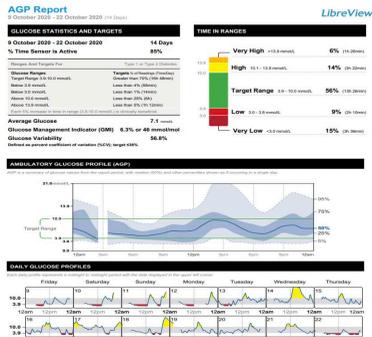
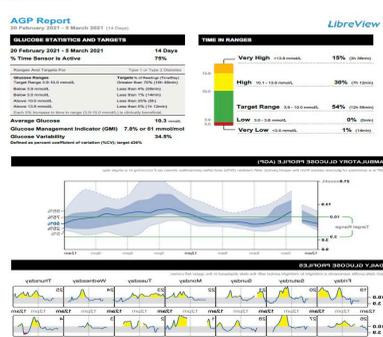


Figure 2 – sample of his Freestyle Libre report in LibreView, with fewer hypoglycaemia episodes



## Conclusion

Comprehensive patient assessment can equip clinicians to offer the most appropriate choices and client advice. Person- centred care and involvement in decision-making facilitates clients to more fully engage in their diabetes management.

Matching the person with the most appropriate care and technology empowers them to better self-manage and get the greatest benefit from their clinical appointments, with a shared role in their diabetes management. Libre View is a great tool for the client and also for the clinician who can review the report remotely, if required.

While this client's current Ambulatory Glucose Profile still does not meet the recommended time in range, he is very keen to achieve better glycaemic control. He has fewer hypoglycaemia events, but his TIR needs further improvement and therefore, ongoing support is needed. The plan is for him to continue to pre-bolus before meals, straighten up his insulin to carbohydrate ratio, make a small adjustment to his basal dose and continue a regular eating pattern.

Getting technology suited to his needs was the first step to improve his TIR and overall diabetes management. He is now more engaged with his health care team, attending all his appointments. The next step is to empower him

through aiding report interpretation, so he can understand patterns and how these can help with diabetes management. This will assist him to identify what is working well for him and for decision making regarding adjustments (1).

In conclusion, Freestyle Libre provided this person with numerous benefits relating to BGL monitoring and decision making regarding his treatment. Improved quality of life and greater patient engagement with his care team are the benefits that were observed during his consultations with the diabetes team.

## References

1. Edelman S. Taking Control Of Your Diabetes: An Innovative Approach to Improving Diabetes Care Through Educating, Motivating and Making the Connection Between Patients and Health Care Providers. American Diabetes Association: San Diego, CA; 2017

# Case five

Julie Loughran

## *Empowering octogenarians*

I work as an inpatient diabetes clinical nurse consultant, covering subacute services at a busy Melbourne Health Service. Many clients are older (age >65) and have prolonged hospital admissions, requiring complex discharge planning. The duration of hospital stay enables a trusting relationship to be built between client and healthcare professional. Many older people being admitted with diabetes are often being classified as 'insulin requiring, IDDM, diabetes mellitus or DM'. Often it is not clear if a person has type 1 or type 2 diabetes and older people who are improperly diagnosed may not gain access to insulin and delivery and monitoring tools, such as pumps or continuous glucose monitoring (1).

Attitudes of the health care professionals towards older adults can be dismissive, resulting in inaccurate diagnoses and Wyman M.F et al (2) state how "Discrimination based on age may be reflected in clinical practice and decision-making among health care providers. Studies using both hypothetical decision-making scenarios and patient record review have demonstrated age-based disparities in diagnostic procedures as well as in the types of treatment offered to patients". (p.196)

This case study looks at the importance of correct diagnosis in older people by listening to the person, and taking a person-centred care approach. The cases discussed reflect the ability of the older client to utilise new technology where, the correct diagnosis leads to improved outcomes.

### Case presentation

Mrs A aged 86 and Mrs B aged 82 were both admitted following a fall and experienced a long stay in hospital. Both experienced unstable diabetes during their hospital admission, resulting in multiple episodes of hypoglycaemia, hyperglycaemia and ketosis. Both were documented on admission as having type 2 diabetes.

Mrs A had been diagnosed with diabetes 50 years ago, went quickly onto insulin and reported that she had self-managed her diabetes with help from her GP. She was unsure of the type of diabetes, but knew she had always required insulin. Antibodies to glutamic acid decarboxylase (anti GAD) results came back during admission >2000, confirming Type 1 diabetes. Mrs A was admitted on Mixtard 30/70 insulin twice a day, titrating her own insulin doses.

Mrs B was admitted with diabetic ketoacidosis (DKA) following a fall and a long lie on the floor. Mrs B was documented as having Type 2 diabetes for more than 35 years, however further detailed assessment with family revealed that Mrs B had been confirmed as type 1 many years ago. Although, diabetes auto antibodies were negative, further communication with private endocrinologist confirmed type 1 diabetes. Mrs B was admitted on Protaphane daily and prn Novorapid 1-3 times a day, titrating her own insulin doses.

Both ladies required excessive capillary blood glucose monitoring during the admission (average 6-8 tests a day) (see Table 1). Both ladies self-monitored blood glucose levels at home, but this was becoming more difficult due to arthritic fingers, poor circulation and poor dexterity. They both had impaired hypoglycaemia awareness, depending on blood glucose monitoring to identify hypoglycaemia and a fear of nocturnal hypoglycaemia, often resulting in insulin omission at home.

Date	Time	0001-0600	Before Breakfast	After	Before Lunch	After	Before Dinner	After	Before Bed	2200-2400
Day1	BGL	2.6	3.8	9.3	9.9		7.9		11.7	9.5
	Ketone									
Day2	BGL	12.5	17.6	11.2	16.7				12.7	10
	Ketone		3.1	0.3	2.6				0.6	0.9
Day3	BGL	10.7	16.0	19	14.6		6.0		9.4	
	Ketone	0.8	3.2	2.6	0.8		0.3		0.5	
Day4	BGL	16.3	20.6	16.4	12.9		7.1	9.3	6.8	
	Ketone	1.6	3.3	1.4	0.4					
Day5	BGL	7.2	14.5		15.0		8.8		6.8	9.2
	Ketone		0.5		1.9		0.4			

Table 1. Blood glucose during initial admission (Mrs A) range 1.2-11.1 mmol/l

### Correct classification of diabetes

In 1980 the World Health Organisation recognised two major forms of diabetes (3). One type was termed insulin-dependent diabetes (IDDM) and the other non-insulin –dependent diabetes (NIDDM). The terms IDDM and NIDDM became confusing, resulting in classifying individuals based on treatment rather than etiology. In 1997 new recommendations for the diagnosis and classification of diabetes were introduced, stipulating the term Type 1 and Type 2 diabetes (4).

The correct classification of type 1 diabetes was documented on medical notes after review with the endocrinologist. Confirmation of the correct type of diabetes meant that both of these ladies were eligible for subsidised Continual Glucose Monitoring. Further investigation revealed that both ladies were already registered as type 1 diabetes with National Diabetes Service Scheme (NDSS). Following a detailed discussion about the devices available, both decided to try the Freestyle Libre Flash Glucose Monitoring System. Firstly, to see if the device would be suitable to manage at home and secondly to obtain more information on their blood glucose profile to help reduce the chaotic reactive management of hypo and hyperglycaemia episodes in hospital. Both completed the NDSS Eligible Concessional Status application form and were granted concession within 1 week.

### Education

Both ladies opted to use the reader to check blood glucose levels and agreed from day one they had an instant improvement in quality of life. Reduced finger pricking, the ability to check more regularly and be guided by the trend arrows being the main benefits initially. They became actively involved in their diabetes management during the end of their prolonged hospital admission. The arrows displaying the current blood glucose trend allowing timely intervention to prevent episodes of hypoglycaemia.

Mrs A and Mrs B were amazed that they were able to use this new technology and understand it. Their quality of life further improved with time in range improving and a significant reduction in hypoglycaemic episodes. However, best of all (or most importantly) both felt empowered to manage their diabetes more effectively and take back the control lost over the years, especially following a long stay in hospital. They were started on the Freestyle Libre Flash Glucose Monitoring System as an inpatient and

both had their insulin regimen changed during the admission and were discharged on Ryzodeg 70/30 with breakfast and Novorapid with lunch and dinner (see Table 2).

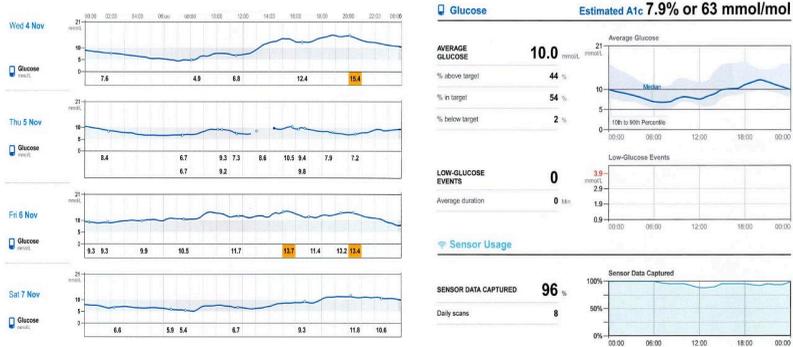


Table 2. Blood glucose levels before discharge (Mrs A) negative ketone level

## Conclusion

Post discharge from hospital both ladies have continued using the flash glucose monitoring system. Their families were involved in the training as neither were able to insert the sensor due to poor dexterity however, family members are able to help. Both ladies continue to feel empowered, maintaining control and dignity and continue to self-manage diabetes taking a proactive approach to reduce episodes of hypoglycaemia. Both reported the positive impact on their quality of life and improved satisfaction of day to day living with type 1 diabetes.

## Discussion

The initial incorrect classification of diabetes on admission is a barrier to accessing newer technologies available for older people living with type 1 diabetes, clarifying the importance of clear documentation and confirmation of diabetes type. Both ladies in this case study experienced a significant increase in their quality of life once they were correctly diagnosed and therefore able to access state of the art new technologies for managing type 1 diabetes. A diabetes diagnosis should never be based on age alone.

## References

1. Thomas NJ, Lynam AL, Hill AV, et al. Type 1 diabetes defined by severe insulin deficiency occurs after 30 years of age and is commonly treated as type 2 diabetes [published online April 30, 2019]. *Diabetologia*. 2019; <http://doi:10.1007/s00125-019-4863-8>.
2. Wyman M.F, Shiovitz-Ezra S, Bengel J. (2018) Ageism in the Health care system: Providers, Patients, and Systems. In: Ayalon L, Tesch-Romer C (eds) *Contemporary Perspectives on Ageism. International Perspectives on Aging*, vol 19. Springer, Cham. [https://doi.org/10.10007/978-3-319-73820-8\\_13](https://doi.org/10.10007/978-3-319-73820-8_13)
3. World Health Organization: *Diabetes Mellitus: Report of a WHO Study Group*. Geneva, World Health Org., 1985 (Tech. Rep. Ser., no. 727)
4. Hirsch. B, 1999, Type-1-and-Change Diabetes, *Clinical Diabetes* VOL. 17 NO. 4 pg146 [http://journal.diabetes.org/clinicaldiabetes/V17N41999/pg146.htm#:~:text=%27Type%2D1%2Dand%2DChange%20Diabetes%27&text=In%201979%2C%20the%20National%20Diabetes,two%20major%20forms%20of%20diabetes.&text=One%20type%20was%20termed%20insulin,%2C%20or%20type%20%20diabetes\).](http://journal.diabetes.org/clinicaldiabetes/V17N41999/pg146.htm#:~:text=%27Type%2D1%2Dand%2DChange%20Diabetes%27&text=In%201979%2C%20the%20National%20Diabetes,two%20major%20forms%20of%20diabetes.&text=One%20type%20was%20termed%20insulin,%2C%20or%20type%20%20diabetes).)

# Case six

**Deborah Schubert**

## ***Double Dilemma: Diabetes and Dementia***

### Introduction

MM is an 83 year old South Asian male ex-professional, residing in Australia with his wife and a daughter. He was diagnosed with Type 1 Diabetes (T1DM) in 1972, which was reclassified as Latent Autoimmune Diabetes in Adults (LADA) in 1991 in Australia.

MM was referred to me, a diabetes nurse educator (DNE), after a hospital admission for hypoglycaemia in March 2018. The hospital discharge summary stated: “stubborn and refusing to adjust his meds despite multiple hypos, refusing to decrease the dose....he knows his diabetes...better than other people”. Prior to admission MM had not had an endocrinology review for three years.

The hospital provided education and reduced MM's insulin to Lantus 20 units mane and Novorapid 30 – 20 units three times a day. His HbA1c in March 2018 was 6.9%. MM has a complex medical history including peripheral arterial disease, hypertension and high cholesterol.

### Assessment

#### *Initial consultation*

MM had been checking his fasting and before bed blood glucose levels (BGLs) with a glucometre, to calculate how much Novorapid to supplement before bed at 0100h. He rarely checked his BGLs during the day. Bedtime BGLs were around 20mmol/L. Snacking prior to bed was ruled out as a cause of hyperglycaemia.

Shortly before his hospital admission, MM supplemented 27 units of Novorapid before bed. He incorrectly calculated the dose with the aim to reduce his fasting BGLs to around 7mmol/L.

MM used syringes instead of lancets to check his BGLs and reused the same syringes to inject both insulins. Some syringes were used so

frequently that the numbers and lines had worn off. MM was drawing his insulin up from a pen-fill not an ampoule and he was reusing 12.7mm syringes to inject into his abdomen and would 'guess' how far to push the needle in to inject into the subcutaneous fat. MM did not record his supplemental doses so it was difficult to titrate his insulin safely. Being very intelligent and the patriarch of his family, MM's family did not intervene in his diabetes management.

### *Dementia diagnosis*

After completing the Wicking University Massive Open Online Course (MOOC) Understanding Dementia in 2018, I associated MM's behaviour with possible cognitive impairment. MM reluctantly agreed to undergo a Rowland Universal Dementia Assessment (RUDAs) and Montreal Cognitive Assessment (MoCA).

MM was reviewed by the Cognitive Dementia and Memory Service (CDAMS) in November 2018. He was diagnosed with vascular disease causing mild dementia with Alzheimer's disease in March 2019.

There are approximately 472,000 Australians living with dementia in 2021<sup>1</sup>. The vascular conditions of high blood pressure, diabetes and high cholesterol, as per MM's medical history, have found to be linked to the development of Alzheimer's disease<sup>2</sup>. Dementia Australia state that people with diabetes and dementia may find daily self-management of checking BGLs and insulin administration very challenging<sup>3</sup>.

MM reluctantly agreed to a referral to home visiting nurses in May 2019 to monitor his morning BGLs and assist with insulin administration. The syringes were switched to pens, a locked box prevented insulin supplementation, fasting and before evening meal BGLs were checked routinely. However, twice daily BGLs did not tell the whole story.

### Management

MM was put on a Libre by the visiting nurses, initially as a trial. MM and his family found the Libre to be user friendly. MM liked being able to check his BGLs at any time with minimum fuss particularly on an overseas holiday to South Asia. MM and his family agreed to pay the ongoing costs of Libre monitoring until March 2020 when funding became eligible under National

Diabetes Service Scheme (NDSS).

An early ambulatory glucose profile (AGP) dated 21/01/20 to 03/02/20 (figures 1a and 1b) shows 12 hypoglycaemia episodes lasting an average of 107 minutes each. The episodes occurred before lunch and in the evening.

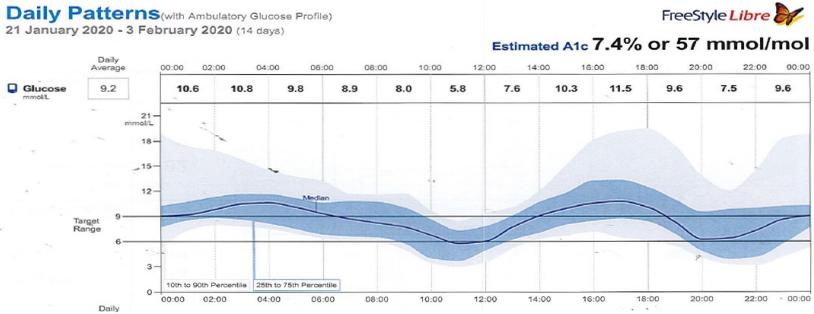


Figure 1a. Daily Patterns 21/01/20 - 03/02/20

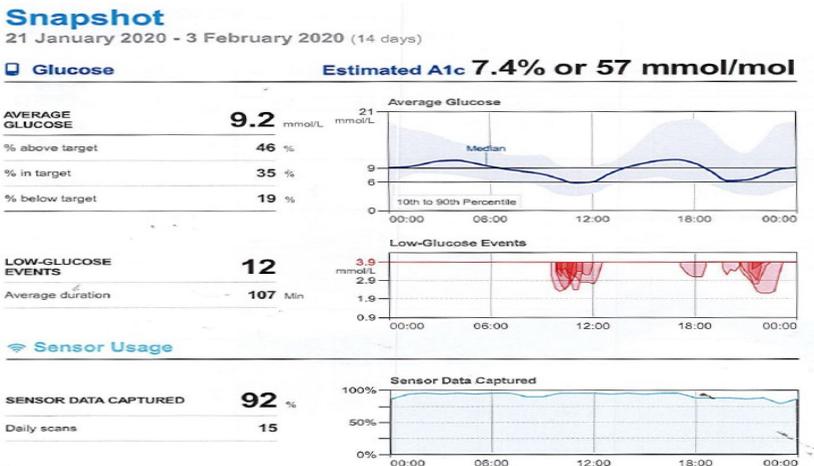


Figure 1b. Snapshot - 21/01/20 - 03/02/20

Dementia can contribute to an alteration of eating patterns, where a snack or meal may be missed due to lack of appetite, distraction or refusal<sup>4</sup>. Lunch and evening meals were sometimes delayed as the family navigated social meals. Based on the observed data, the lunchtime Novorapid was

ceased and the family was advised to ensure MM had regular snacks and meals.

## Conclusion

Although, hypoglycaemia events continue to occur, the incidence and duration has reduced. This is demonstrated by an AGP dated 12/05/21 to 25/05/21 (figures 2a and 2b), where only one hypoglycaemia event lasting 75 minutes was recorded.

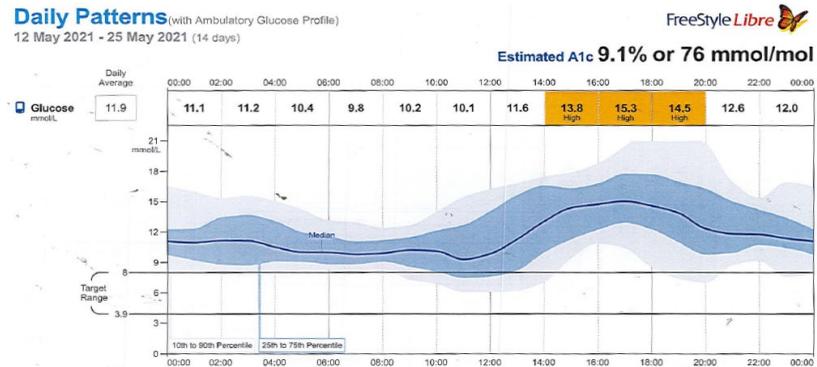


Figure 2a. Daily patterns 12/05/21 - 25/05/21

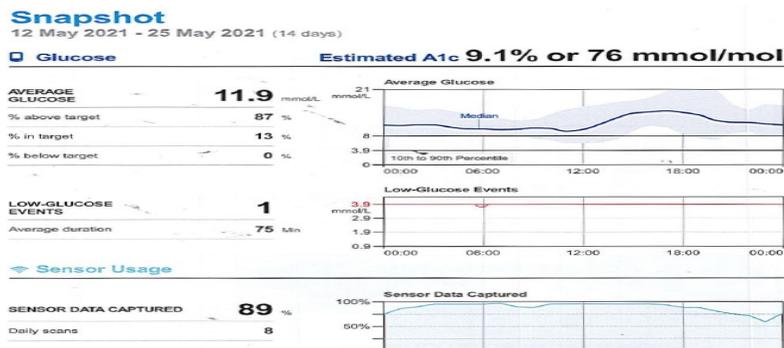


Figure 2b. Snapshot 12/05/21 - 25/05/21

MM is confident in checking his own BGLs as the device is easier and quicker to use than previous glucometres. It provides him the control to check his BGLs at any time.

The most useful Libre data includes the number of hypoglycaemia episodes, the duration of the episodes, and the estimated HbA1c. This information is simple to compare between reports and the data is easily uploaded to MM's medical file.

As a result, it has improved the data available to and communication between the health services, which allows for safer titration and the reduced risk of hypoglycaemia.

## References

1. Dementia Australia. Dementia Statistics [internet]. Dementia Australia; [updated January 2021, cited 2021 June 23]. Available from: <https://www.dementia.org.au/statistics>.
2. Dementia Australia. Vascular Dementia [internet]. Dementia Australia; [updated 2020, cited 2021, June 23]. Available from: <https://www.dementia.org.au/about-dementia/types-of-dementia/vascular-dementia>
3. Dementia Australia. Doubled risk of dementia for 1 in 5 Australians with Diabetes [internet]. Dementia Australia; [updated November 14 2014, cited 2021 June 23]. Available from: <https://www.dementia.org.au/about-us/news-and-stories/news/doubled-risk-dementia-1-5-australians-diabetes>
4. Cipriani G, Carlesi C, Lucetti C, Danti S, Nuti A. Eating Behaviours and Dietary Changes in Patients With Dementia [internet]. 2016 Oct [cited 2021 June 23]; 31 (8): 706-716. Available from: <https://www.doi.org/10.1177/1533317516673155>

# Case Seven

Louise Vaughan

## *Increasing Time In Range (TIR) Pre and post conception*

### Introduction

30 year old Kate\* attended the diabetes clinic following referral from her GP with an elevated HbA1c of 8.2%

*\* Name changed for confidentiality*

### *History*

1. Type 1 diabetes (T1DM) diagnosed age 14 years
2. Infrequent engagement with the clinic, although remains in frequent contact with her long-standing GP
3. Adequate pump knowledge judged by use of insulin pump therapy, nil admissions with adverse acute diabetes related event (DKA or hypoglycaemia) and no evidence of diabetes complications as per recent GP assessment
4. Works in administration, has a supportive employer allowing flexibility to attend appointments
5. Kate relayed she was planning first pregnancy soon, has supportive partner
6. No other medical history apart from T1DM, nil significant family history
7. Limited planned exercise, has not seen a dietitian for many years, currently carbohydrate counts
8. Weight: 63kgs, height 1.70cm, BMI 21.7

### *Medications*

1. Novorapid
2. Elevit pregnancy supplement

## *Most Recent Pathology*

HbA1c 8.2%, cortisol 237, vit D 106, eGFR >90, creatinine 71, Urine ACR 1.0, normal LFT, TSH 2.02, Hb 143, B12 655, anaemia screen normal

## Assessment

The working diagnosis is suboptimal glycaemia with HbA1c at 8.2%, with aim HbA1c of <6.5% preconception (1). Kate has used insulin pump therapy continuously for 10 years. The pump has Continuous Glucose Monitoring (CGM) capability.

As Kate was planning pregnancy an application for CGM under the NDSS was undertaken and granted. Despite education, Kate found this technology troublesome. In particular she found alarms annoying, calibration an inconvenience and felt the trace was “inaccurate”. There was bleeding at insertion sites resulting in non-performance of the sensor and as result Kate wanted to stop CGM.

In light of Kate actively trying for pregnancy (despite advice to delay this until glycaemia was optimal) we discussed alternate options. Kate agreed to trial the Freestyle Libre Flash Glucose Meter (FGM) and found ease of insertion, no calibration requirement and swipe function more appropriate. The use of FGM improved quality of life as she found it to be less stressful.

The management plan was to work closely with Kate, utilising Libreview to view the daily log and AGP report specifically, to identify trends and adjust her insulin pump accordingly. It also helped identify other patterns that could improve glycaemic management via behaviour modification.

## Management

Kate was counselled about increased risk of adverse effects (congenital anomalies, miscarriage, shoulder dystocia, macrosomia and still birth) if falling pregnant with a preconception HbA1c >6.5% (1). Despite this, Kate ceased the oral contraceptive pill. This manifested in a limited time frame to bring the HbA1c down whilst working in partnership with her prior to conception.

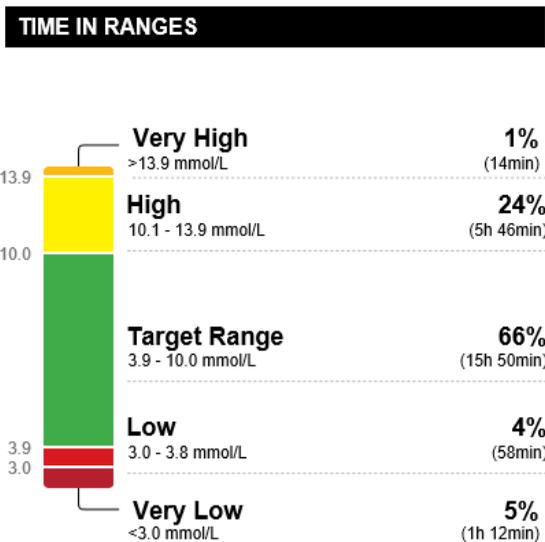
Initial LibreView assessment showed labile glycaemia with average glucose of 9.9mmol/L, 54% Time In Range (TIR), 45% above target and 1% below target.

Innovative ways were used to increase TIR as demonstrated below. Kate was educated on how lifestyle and physiological factors also influenced her glycaemia.

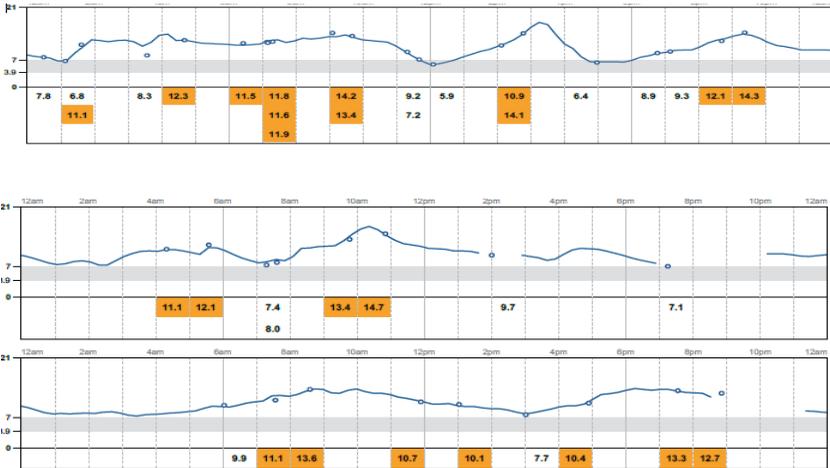
Following full physical assessment, it was noted Kate had marked lipohypertrophy on the upper left and right abdominal quadrants. She was encouraged use of buttocks for set sites until this resolved.

Kate was reviewed fortnightly. Ongoing pump adjustment along with change of set site to avoid lipohypertrophy, saw a dramatic improvement in glycaemia in a 4 week period. The AGP Report showed TIR now at 66%, noting a reduction of 11.1 units in basal pump settings with improved insulin absorption due to avoidance of lipohypertrophy.

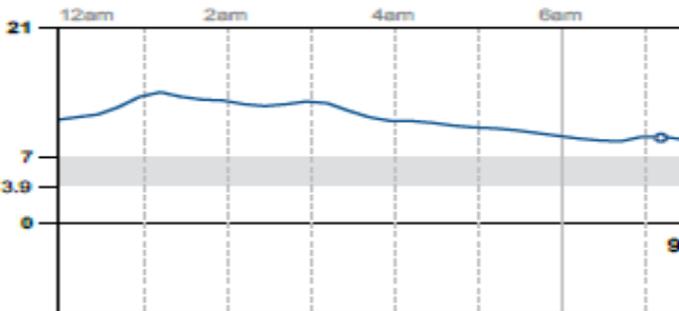
## LibreView



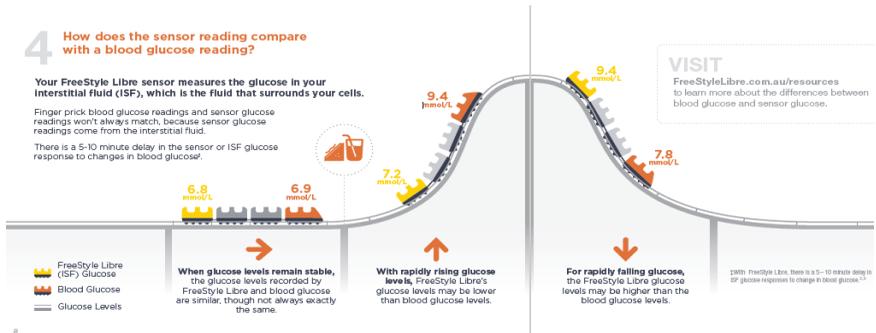
The daily log demonstrated an increase in glycaemia as a result of the menstrual cycle. A phenomenon Kate thought existed but was now clear. She was advised to increase her pump to 120-130% on temporary basal setting to manage hyperglycaemia on these days.



The daily log highlighted how a high fat, high protein meal saw a drop in glucose initially, followed by hyperglycaemia 4-6 hours afterwards overnight. Kate was educated regarding a 20% fat and protein supplement using a dual wave bolus (70/30) over 3 hours (2), to gauge effect and adjust duration and split accordingly.



Kate had some challenges with the Libre trace reading differently compared to fingerstick. We discussed blood versus interstitial glucose and the roller coaster analogy was used to explain (3)



Kate was seen on a 2 weekly basis to regularly review data and adjust pump rates with timely and significant improvement resulting. The visual representation of the daily log and AGP report helping Kate understand the effect of the above and what behaviour modification could lead to increased TIR. She was “happier” and clearly more confident and enlightened with LibreView informing pump adjustment. The visual use of the TIR graph assisted her strive towards her goals.

## Conclusion

Kate found it incredibly beneficial to see where the glucose is “now”, where it has “been” with up to 8 hours of glucose history and where it is “going” (trend arrow).

This enabled informed management choices contributing to improved TIR. Pregnancy was also a major motivator in her readiness for change. Kate stated she gained confidence in diabetes self-management and felt physically and mentally “better” with improved levels.

Kate’s HbA1c decreased to 7.1% over 10 weeks when she informed me she was 4 weeks pregnant.

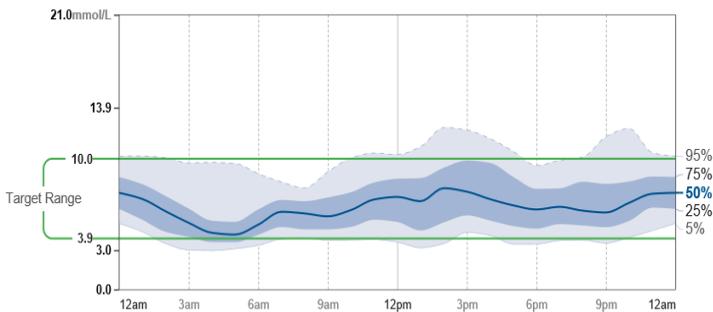
Kate engages weekly, emailing pump and LibreView reports for analysis allowing insulin adjustment in line with ADIPS guidelines (1). Whilst the target of 6.5% pre-conception was not met, the reduction to 7.1% was a significant improvement over a short time period. LibreView and the AGP remain an important part of ongoing data analysis potentially preventing adverse events in mother and foetus.

Libre used in pregnancy is highly transferrable to other women pre, during and post conception (including breastfeeding). This is in part due to NDSS subsidisation for these indications and also as it is a well-accepted method of monitoring glycaemia. LibreView and the AGP report allow ease of data analysis, are time effective tools for CDEs, NPs and Physicians to gather data efficiently informing medication and behavioural modification.

Kate's current TIR is 83%, GMI 6.1%, average glucose 6.4mmol/L and glucose variability 34.7%. There are no pregnancy complications to date at 15/40 gestation.

#### 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.



## References

1. Rudland V, Price S, Hughes R, Barrett H, Lagstrom J, Porter C, Britten F, Glastras S, Fulcher I, Wein P, Simmons D, McIntyre H.D, Callaway L. Australian Diabetes in Pregnancy Society. Position Papers 2020: ADIPS 2020 guideline for pre-existing diabetes and pregnancy. Aust N Z J Obstet Gynaecol 2020; 60: E18-E52. Available from: <https://obgyn.onlinelibrary.wiley.com/doi/epdf/10.1111/ajog.13265>
2. Smart C, Pappas M, Fisher E. Dosing for Fat and Protein. John Hunter Children's Hospital, Children, Young People and Families
3. Abbott. Freestyle Libre Flash Glucose Monitoring System: Tips & Tricks, Why Prick When You Can Scan Booklet.

# Case Eight

Margret Whillier

## ***Freestyle Libre and pre-operative diabetes optimisation - how technology and care can create a positive impact***

### Introduction

Lindy\* is a 59-year-old woman with diabetes mellitus secondary to pancreatic insufficiency. Lindy was referred to our Preoperative Diabetes Optimisation Clinic by the vascular team to optimise her diabetes prior to her having an angiogram and stent for left tight distal superficial femoral artery stenosis.

This case study is about her involvement with our service over 7-weeks, from referral date to the day of surgery. Optimisation of her diabetes preoperatively should reduce the risk of post-operative complications, in particular surgical site infections, negate the need to be admitted the day before surgery for glucose control and reduce the risk of surgery being cancelled due to hyperglycaemia. The Australian Diabetes Society recommend a HbA1c <8% preoperatively to reduce these risks. (1)

*Medical history includes:*

- Chronic recurrent pancreatitis secondary to familial hypertriglyceridaemia
- Depression

*Medications include:*

Insulin aspart (Novorapid®), Insulin glargine (Optisulin®), pancreatic enzymes, duloxetine, venlafaxine, oxycodone and diazepam.

Lindy lives with her carer and she receives a disability pension. Her height is 157cms and weight 66kgs (BMI 26.8). Her HbA1c on referral to the clinic was 11.2%, haemoglobin 132, creatinine 47 and eGFR >90 ml/min.

\* Name changed for confidentiality

## Assessment

The stenosis in her leg was impacting the quality of her life and self-management of diabetes. She was taking pain relief, hadn't monitored her blood glucose levels (BGLs) for months and frequently missed insulin doses that had led to several admissions with diabetic ketoacidosis. This was having a huge impact on her mental health; her depression was worsening.

The Problem Areas In Diabetes (PAID) questionnaire measures diabetes-related emotional distress and is linked to diabetes control; Lindy's PAID score at referral was 71.25 indicating a high level of diabetes distress. (2) The goal was to improve her glucose levels so that she could safely have the surgery she needed to improve the quality of her life.

Lindy was prescribed prandial Novorapid® and Optisulin® at night. Doing fingerprick BGLs was an on-going and significant barrier to achieving her goals. She resented having to do it, didn't feel any different, did not make any decisions based on the results and had become unmotivated to monitor. She said, "I don't feel any different so why do it?". Having been to this clinic, we were able to provide her with a Freestyle Libre sensor to undertake flash glucose monitoring (FGM). Being able to perform FGM was life changing. She has subsequently continued on FGM through the National Diabetes Services Scheme.

## Management

With her endocrinologist we reviewed the data weekly using Libreview, looking for any hypoglycaemia, assessing time in range and glucose variability, this information guided insulin dose adjustment. Being able to link her with Libreview was important as we could reliably access her data remotely, reducing the number of face-to-face appointments and avoided frequent hospital visits that usually increased her anxiety.

The weekly reviews included discussions about:

- carbohydrate intake
- injection technique
- insulin stacking
- possible causes and treatment of hypoglycaemia
- mental health

Each week we provided feedback about the incredible progress she was making. She was logging all her meals and doses into the app. She said “Libre is making me more accountable and is influencing my food choices as I can now see the impact of carbs on my glucose levels”. She was becoming more engaged with her condition and was starting to see some positive changes.

	Week 2	Week 7
Very High	76%	29%
High	18%	34%
Target Range	5%	34%
Low	1%	2%
Very Low	0%	1%
Average Glucose	16.1mmol/L	11.5mmol/l
Glucose Management Indicator	10.2%	8.2%
Glucose Variability	23.3%	36.7%

Table 1. Glucose Statistics and Time In Ranges

Here are some snapshots from Libreview that compare her data between week 2 and week 7:

## AMBULATORY GLUCOSE PROFILE (AGP)

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

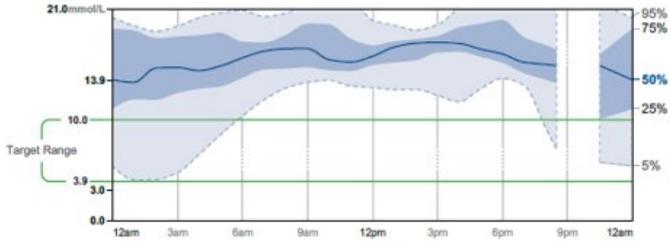


Figure 1. Ambulatory Glucose Profile during week 1 and 2

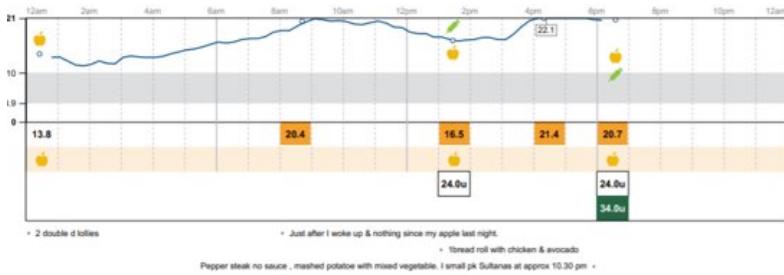


Figure 2. Daily graph during week 1

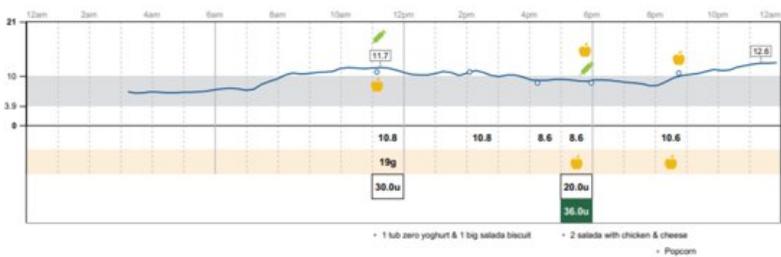


Figure 3. Daily graph during week 6

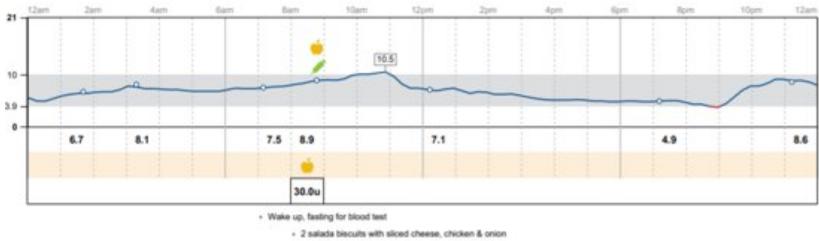


Figure 4. Daily graph during week 7

## Conclusion

Over the 7 weeks of using the Freestyle Libre and engaging in the Preoperative Diabetes Optimisation Clinic Lindy was able to improve her glucose levels significantly safely enabling her to have her much needed surgery.

She's more engaged in her health and described it as being "a very positive experience, I have my confidence back. I'm now in control and diabetes is not in control of me". The previous barriers to satisfactory self-monitoring of her BGLs including undertaking fingerpricks and maintaining a diary were non-existent; adopting FGM resulted in greater patient engagement.

The benefits to her mental health and quality of life can be seen in the significant reduction in her PAID score over the 7 weeks, decreasing from 71.25 at referral to 18.75 on the day of surgery. She's had no recurrence of diabetic ketoacidosis since commencing Libre 2 months ago. The improvement in her overall glucose control was reflected by her calculated HbA1c (her glucose management indicator) being 8.2% on the day of surgery.

Her case is an excellent example of how the effective use of technology, in this case with FGM, overcame numerous barriers to improving glucose control prior to surgery. Poor glycaemic control prior to surgery is associated with higher post-operative surgical site infections and longer length of stay significantly increasing costs. These were avoided in this case. Use of Freestyle Libre during the preoperative period for people with diabetes has the potential to improve surgical outcomes, reduce length of stay, decrease costs and improve long term self management.

## References

1. Australian Diabetes Society. Peri-operative diabetes management guidelines 2012. Available at <https://diabetessociety.com.au/documents/PerioperativeDiabetesManagementGuidelinesFINALJuly2012.pdf> [Accessed 26 June 2021].
2. Polonsky W, Anderson B, Lohrer P, et al. Assessment of Diabetes-Related Distress. *Diabetes Care* 1995;18(6):754-60.

# Case Nine

**Wei Zhang and Kaye Farrell**

## ***Young adult with type 1 diabetes empowered by benefits of Freestyle Libre***

### Introduction

AM is a 22 year old young man with a complicated social background. He arrived in Australia in 2005 from Africa as a refugee with his parents and 4 siblings. His older brother has type 1 diabetes mellitus (T1DM). AM was diagnosed with T1DM in 2008 aged 9. He has consistently struggled with diabetes self-care, such as healthy diet, insulin injections, self-monitoring blood glucose level (BGL) and hypoglycaemia prevention and management.

AM was always hard to engage in diabetes self-care after he transitioned to the Young Adult Clinic from the Children's Hospital in 2015 when he was in Year 11. He resisted doing insulin injections or BGLs at school due to peer pressure. He was on Mixtard 30/70 15 units with breakfast, Actrapid 20 units with late lunch after school and Optisulin 20 units at bedtime. Diabetes management was tailored to provide maximum insulin doses with least number of injections.

His socio-economic background and limited health literacy also impacted on poor food choices containing high carbohydrate load and high glycaemic index (GI) food, such as juice, energy drinks, burgers, chips and his favourite Nutella sandwich. This was reflected in his BGLs range which was 4-30mmol/L across the day.

### Assessment

He visited the clinic with his mother and brother every 3 months. His HbA1c fluctuated between 11.0-14.0% and he had no diabetes complications. However, AM has impaired hypo awareness and feels symptomatic when his BGLs are < 3mmol/L. The Endocrinologist suspected he was having overnight asymptomatic hypoglycaemia (hypo) episodes. In December

2020, he had a severe hypo that needed ambulance callout but not hospital presentation. This event was triggered because he did not eat after insulin injection and BGL fell to 2.0mmol/L.

After finishing TAFE, AM works with his father as a delivery driver. He has a busy life and optimising diabetes management has been challenging given he works 6-7 days. It is difficult for him to have regular meals with healthier options and attend to diabetes care. His mental well-being has been impacted by fear of hypo, and the need to check BGLs while driving has increased his stress levels.

Fisher (2016) reported over 40% of adults with T1DM had varying degrees of stress which manifested as powerlessness. Furthermore, as in AM's case, Kreider (2017) showed diabetes distress impacts people's ability to perform daily diabetes self-management and they commonly withdraw from diabetes care team.

## Management

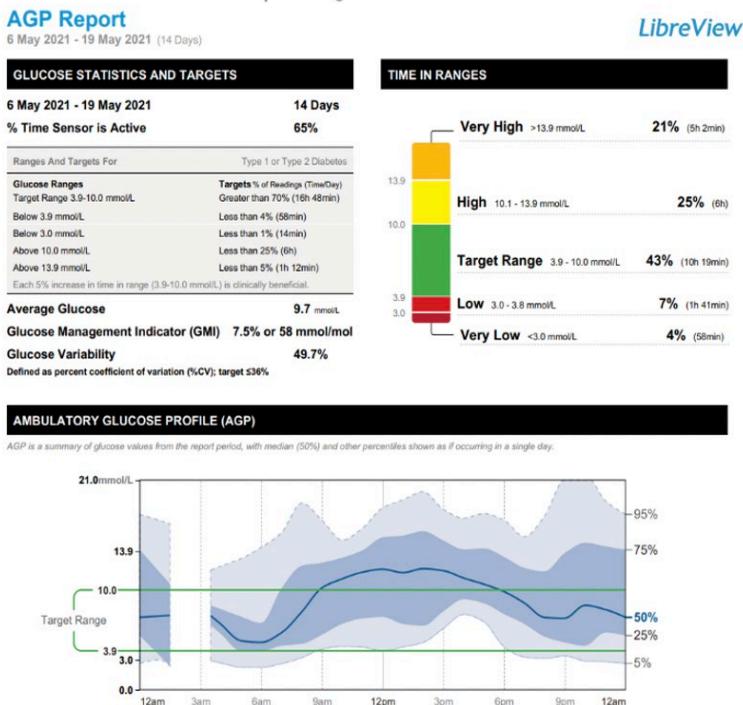
After an 18month hiatus from late 2019, compounded by COVID-19 anxiety, AM returned to clinic in March 2021. At this visit HbA1c was 9.7% which the treating team thought could be attributed to higher self-titrated insulin doses or asymptomatic hypos. His insulin regimen was adjusted in response to his change in meal pattern and daily activities to Actrapid 20-25 units with breakfast, Mixtard 25 units with lunch and Optisulin 16 units at bedtime. He is reluctant to change to basal bolus insulin due to increased frequency of injection and Mixtard at lunch is intended to cover his lunch, afternoon snack and dinner.

FreeStyle Libre flash glucose monitoring (FGM) was introduced to him at this visit to detect hypo events and to provide glucose profiles for insulin adjustment. Eligible due to health care card AM was registered for NDSS subsidised FGM. Diabetes Educator provided FGM education including Libre function, lag effects, timing and frequency of sensor scanning, interpretation of sensor glucose trend arrow, as well as healthy food options and lifestyle modifications.

AM returned for clinic review after wearing FGM for 6 weeks with a big smile on his face. FGM has eliminated his need to do finger prick BGLs and makes his life easier and safer working as a delivery driver. He was reminded to scan sensor at least every 8 hours, particularly before bed as

some data were missing. Analysis of the ambulatory glucose profile (AGP) identified asymptomatic hypoglycaemic events, significant glucose variability, persistent hyperglycaemia, and inappropriate injection-meal intervals. He also revealed he had not initiated the insulin dose changes from previous visit. Given AM's impaired hypoglycaemia awareness, AGP also revealed a trend of overnight hypoglycaemia and identified the precipitating cause was excess Optisulin. To prevent hypos and rebound hyperglycaemia, he agreed to take fixed dose Optisulin (20 units) at bedtime rather than self-titrating (Figure 1).

Figure 1. First AGP after 6 weeks wearing FGM

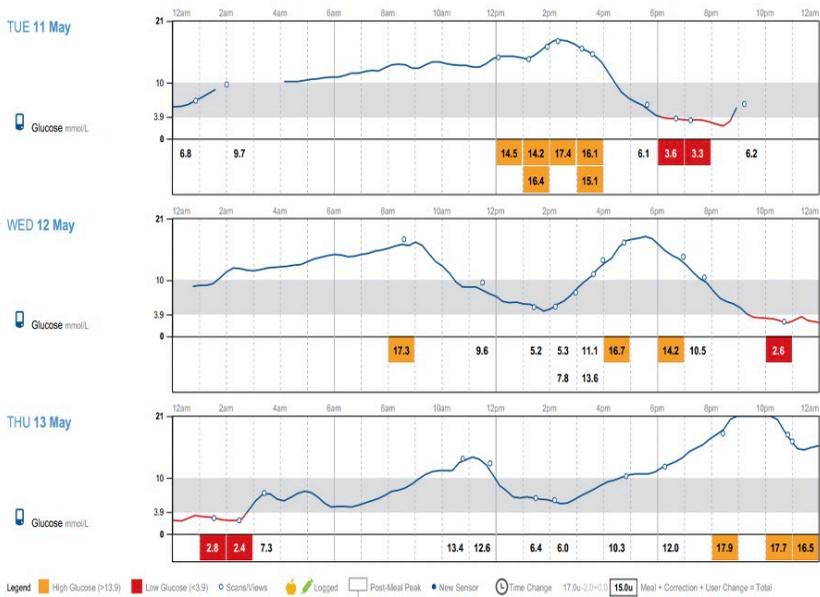


Time in target range (TIR) was discussed with AM as HbA1c does not reflect glycaemic excursions, hypoglycaemia, or provide data to adjust the treatment regimen. The Australian Diabetes Society recommend that

people with T1DM achieve TIR (BGL 4.0-10.0 mmol/L) above 60% per day. AM's AGP showed a TIR of 43% and a glucose management indicator estimate of 7.5%.

Delayed Mixtard injection, 1-2 hours post lunch, resulted in post prandial glucose excursions (Figure 1 & 2). The FGM graph also demonstrated post dinner hyperglycaemia was due to suboptimal insulin regimen. By providing AM a better understanding of insulin action on BGLs he may consider basal bolus insulin regimen.

**Figure 2. AM Daily Log of first FGM report**



**Conclusion**

FGM was a useful tool to assist AM in visualising the significant glucose variability (49.7%) and postprandial glucose excursions which mainly were generated by high GI food and drinks and erratic eating habits (Figure 2). He is motivated to improve BGLs and reduce glucose variability to prevent diabetes complications.

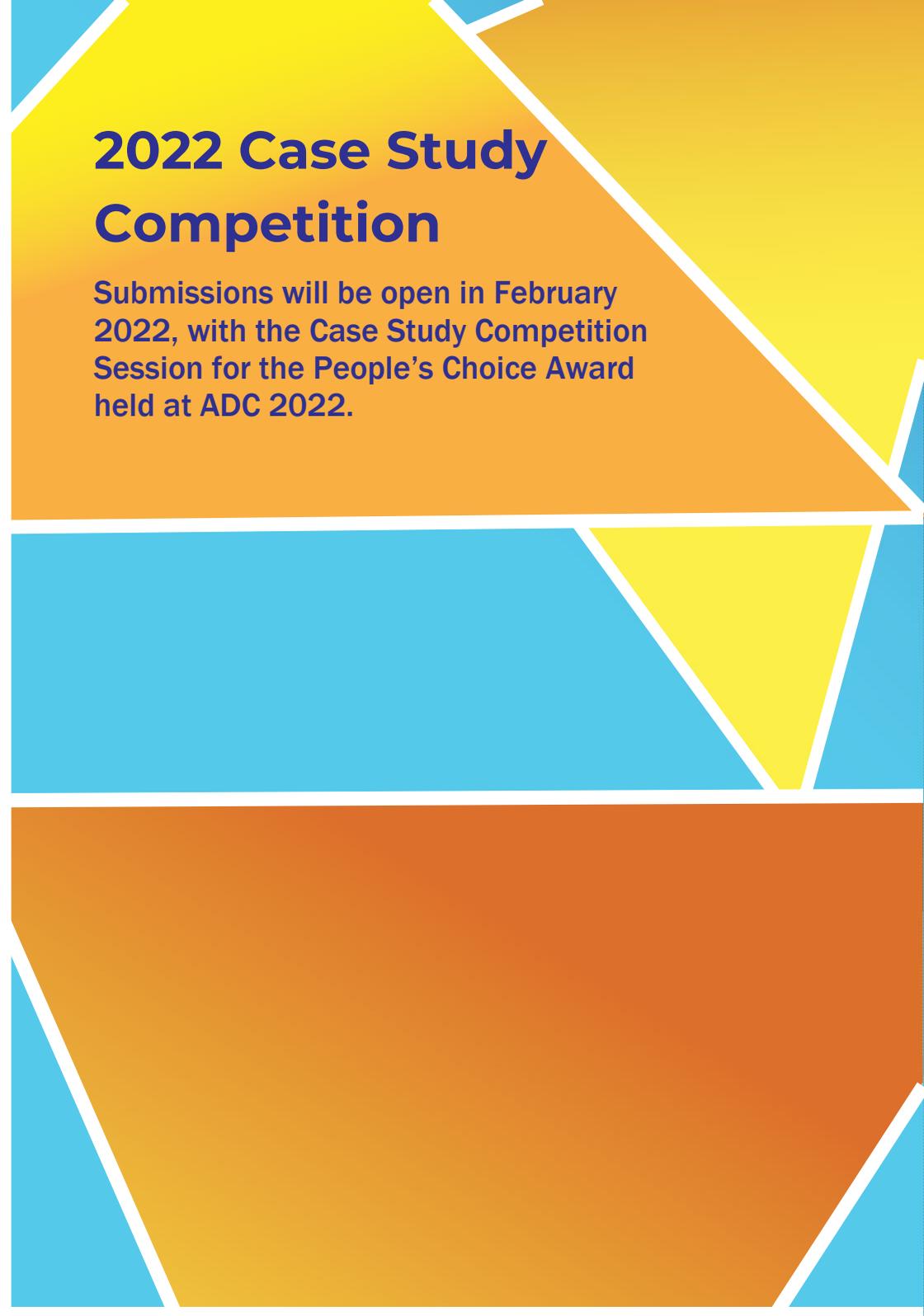
In general, AM was very happy with FGM and felt it had improved his confidence and quality of life. AM and his diabetes care team are looking forward to seeing more positive effects from his use of FGM. The limitation of FGM is that it does not provide alerts for high or low BGLs and relies on consistent scanning of sensor by users. This limitation could be eliminated by proposed FGM products.

In conclusion, FGM provides sensor glucose data for treatment adjustment resulting in reduced hypoglycaemia events, improved metabolic management and glucose variability without frequent finger pricking. FGM also provides a sense of safety and fulfilment which empowers users to take control of diabetes self-management. For people with T1DM, NDSS subsidised FGM should be available across all age groups as it can significantly improve quality of life and mental well-being.

## References

1. Abbott Diabetes Care. Ambulatory Glucose Profile and Time in Range Quick Guide. Australia, 2020.
2. Australian Diabetes Society (ADS). Consensus Position Statement on: Utilising the Ambulatory Glucose Profile (AGP) combined with the Glucose Pattern Summary to Support Clinical Decision Making in Diabetes Care. 2019.
3. Fisher L, et al. Diabetes distress in adults with type 1 diabetes: Prevalence, incidence and change over time. 2016. Journal of Diabetes and Its Complications. Vol 30, Iss. 6: 1123-1128. DOI:10.1016/j.jdiacomp.2016.03.032
4. Kathryn Evans Kreider. Diabetes Distress or Major Depressive Disorder? A Practical Approach to Diagnosing and Treating Psychological Comorbidities of Diabetes. 2017. Diabetes Ther (2017) 8:1–7 DOI 10.1007/s13300-017-0231-1.

# Notes



# **2022 Case Study Competition**

**Submissions will be open in February  
2022, with the Case Study Competition  
Session for the People's Choice Award  
held at ADC 2022.**