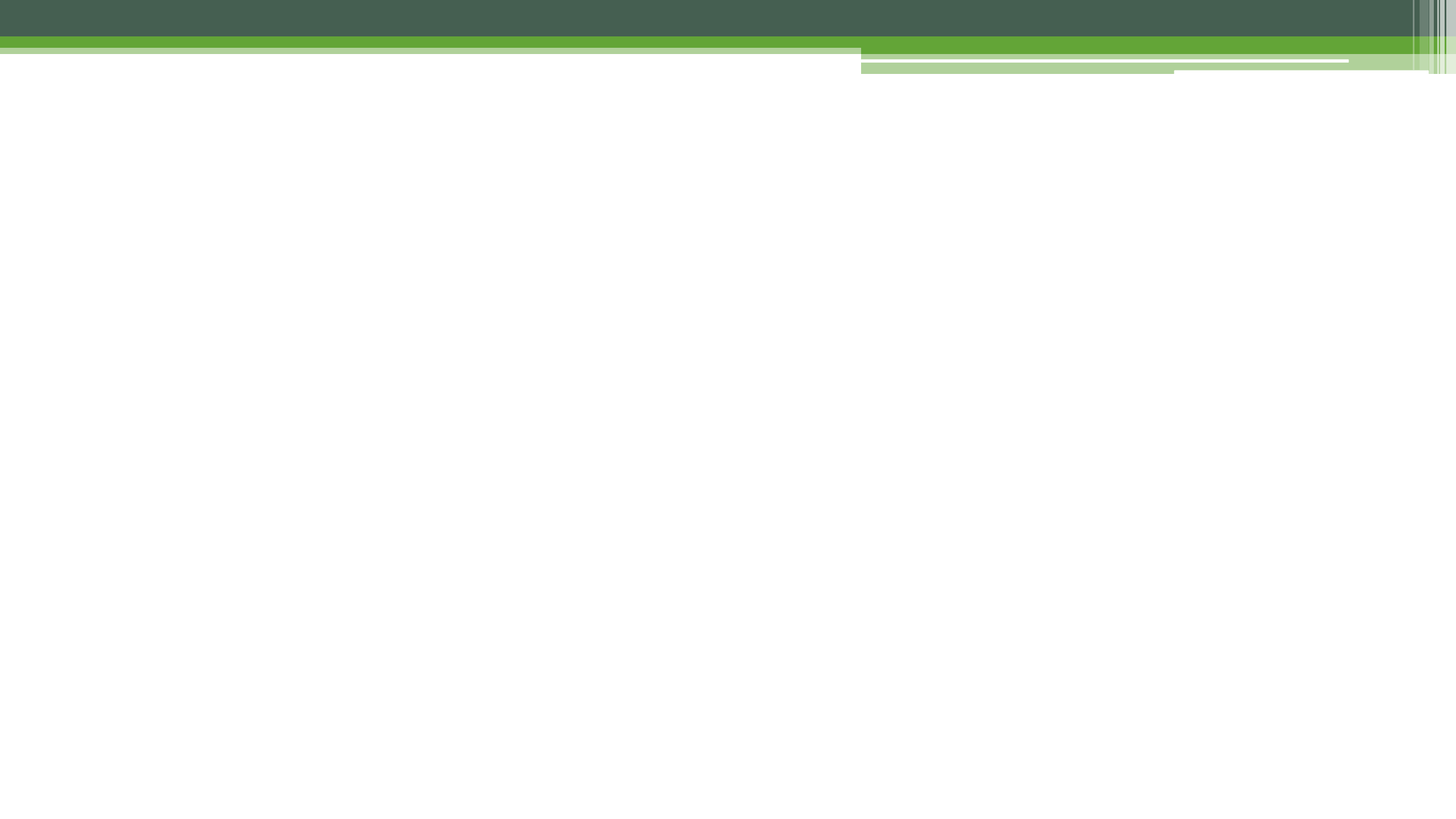


PREGANCY & TECHNOLOGY IN TYPE 1 DIABETES

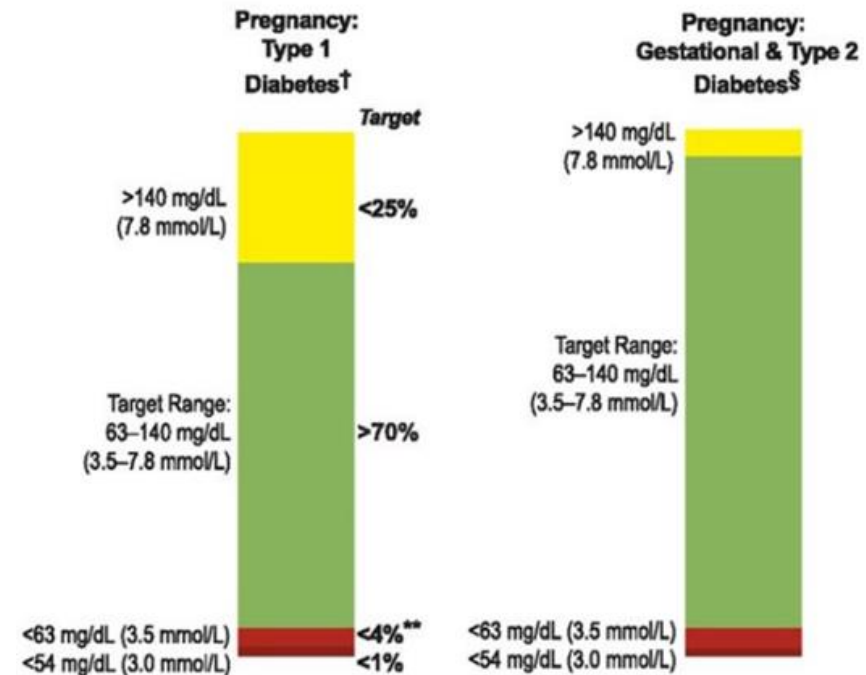
Caroline Byrne

Diabetes Specialist Nurse



Optimise Glucose

- Glucose target
 - HbA1c < 48 mmol/mol (without problematic hypos)
 - Average glucose ~7.0-7.5 mmol/l
 - At least 70% time in range 3.9-10.0 mmol/l
 - < 4% time below range
- Glucose targets in pregnancy
 - Fasting < 5.3 mmol/l
 - 1 hour post meal < 7.8 mmol/l
 - Mean glucose 6.0 - 6.5 mmol/l
 - 70% TiR 3.5 – 7.8 mmol/l
 - Typically TiR drops to 50-60% at pregnancy
 - Every 5% improves outcomes



Can Technology Make the Difference?

- Pumps-now all HCL




- Sensors- Conceptt data



- Hybrid Closed |
Aidaptt



Conceptt to clinical improvements



National Pregnancy in Diabetes Audit 2021 and 2022, England and Wales*

* This audit does not include pregnancies in women with gestational diabetes (diabetes that develops in pregnancy)

Findings


Diabetes is a serious condition where your blood glucose level is too high. When you've got type 1 diabetes, you can't make any insulin at all. If you've got type 2 diabetes you have some insulin but either you can't produce enough or it doesn't work effectively.

In 2021 and 2022 there were **10,055 pregnancies recorded for women with type 1 diabetes and type 2 diabetes.**

Most women with diabetes have a healthy baby, but having diabetes means that you and your baby are more at risk of serious health complications during pregnancy and childbirth. Planning for pregnancy when you have diabetes, and getting support from your healthcare team means you can really reduce the risks involved. Getting the right care at the right time and understanding how you can look after yourself means you're more likely to enjoy a healthy pregnancy and give birth to a healthy baby.

Pregnant women with diabetes in 2021 and 2022

Type 1



44%

Type 2



55%*

* 1% of pregnant women with diabetes had other rarer forms of diabetes such as MODY (Maturity Onset Diabetes of the Young) and LADA (Latent Autoimmune Diabetes in Adults) or unspecified diabetes

95% of women with type 1 diabetes wore continuous glucose monitors in 2022*



improving:

glucose levels
for mothers

outcomes
for women and babies

* Accurate data on CGM use has only been available since 2022

continued >

1,024 x 724

Continuous Glucose Monitoring in Women with Type 1 Diabetes in Pregnancy Trial



Co-Principal Investigators:
Dr Denise Feig, Canada & Prof Helen Murphy, UK





HCL research to clinical recommendation

AiDAPT Automated insulin Delivery Amongst Pregnant women with Type 1 diabetes

NIHR National Institute for Health Research
LEA JCHR

Dexcom G6 CGM with usual insulin vs. CamAPS FX Hybrid closed-loop system

63 received CGM with usual insulin
61 received closed loop

124 pregnant women took part

- Randomised controlled trial
- 9 NHS sites across England, Scotland & Northern Ireland
- Pregnant women with T1D and HbA1c 48-86 mmol/mol

BENEFITS OF CLOSED-LOOP THERAPY

Closed-loop users spent 68% time in range throughout pregnancy. This was 10.5% more than those using CGM with usual insulin

Closed-loop users also had

- 12% more time in range overnight
- 10% less time above range
- lower HbA1c over pregnancy
- less overnight hypoglycaemia

11% increase with usual insulin + CGM vs. 20% increase with closed-loop

Time in range (3.5-7.8 mmol/L)

Mothers using closed-loop also had 3.7 kg (8 lb) less weight gain

Closed-loop was safely started in the first trimester both in insulin pump and injection users

Teamwork is key to closed-loop success:

- The woman:** "A lot of it is the motivation you get and not when you're working for the glucose etc..."
- The tech:** "First closed loop system for T1D pregnancy"
- Healthcare team:** "Wants to continue every 2-4 weeks"

WHAT DOES THIS MEAN FOR WOMEN AND THEIR BABIES?

Thanks to the women on the AiDAPT study, the future looks different for pregnant women with type 1 diabetes. All women with type 1 diabetes will be offered closed-loop. This will mean better glucose control and better baby outcomes for all.

Full results can be found at: <https://www.nice.org.uk/guidance/TA826>
and <https://www.diabetesresearch.org.uk/2022/11/07/>

NICE RECOMMENDS LIFE CHANGING TECHNOLOGY IS ROLLED OUT TO PEOPLE WITH TYPE 1 DIABETES

PRESS RELEASE
NICE recommends life changing technology is rolled out to people with type 1 diabetes

An announcement of the recommendations was made today (Tuesday 7 November) at NICE's annual conference in Manchester by NICE chief executive Dr Sam Roberts



Thousands of people with type 1 diabetes could be offered wearable technology to help them manage their condition following the publication of final draft guidance by NICE.

An independent NICE committee has recommended people whose diabetes is not controlled with their current device despite best possible management with an insulin pump, or real-time or intermittently scanned continuous glucose monitoring, are offered a hybrid closed loop system.

ABOUT THE RECOMMENDATIONS

1. Hybrid closed loop systems are recommended as an option for managing blood glucose levels in type 1 diabetes for adults who have an HbA1c of 58 mmol/mol (7.5%) or more, or have disabling hypoglycaemia, despite best possible management with at least 1 of the following:

- continuous subcutaneous insulin infusion (CSII)
- real-time continuous glucose monitoring
- intermittently scanned continuous glucose monitoring.





2. Hybrid closed loop systems are recommended as an option for managing blood glucose levels in type 1 diabetes for children and young people.



3. Hybrid closed loop systems are recommended as an option for managing blood glucose levels in type 1 diabetes for people who are pregnant or planning a pregnancy.

07 November 2023



	CAM APS FX	SmartGuard	Control IQ	SmartAdjust
				
Licensed for use in pregnancy	Yes	No	No	No
Compatible Pump	Ypsomed Dana RS & I	Medtronic 780G	Tandem T-Slim	Insulet Omnipod 5
Compatible sensors	Dexcom G6, Libre 3	Guardian 4	Dexcom G6	Dexcom G6
Algorithm	Uses TDD and body weight Adjusts insulin every 8-12 minutes to achieve personalised target	Uses TDD from last 2-6 days Automated corrections (max every 5 mins)	Modifies programmed basal rate according to glucose Automated Corrections (max 1/hr) to target 6.1 mmol/l	Automated basal based on programmed basal rates (after first pod changes based on TDD)
Glucose Target	Default 5.8 Personalised 4.4 – 11.0	5.5, 6.1 or 6.7 Temp target 8.3	Standard 6.3 – 8.9 Sleep 6.3 – 6.7 Exercise 7.8 – 8.9	6.1, 6.7, 7.2, 7.8 or 8.3
Adjustables	I:C ratio	I:C ratio Active insulin time	I:c ratio Basal rates Correction factor	I:c ratio Correction factor Active insulin time
Sleep mode target glucose	Yes Customisable	No	Yes 6.3 – 6.7	Yes Customisable
Sharing platform	Glooko / Diasend	Carelink	Glooko / Diasend	Glooko / Diasend

CamAPS FX



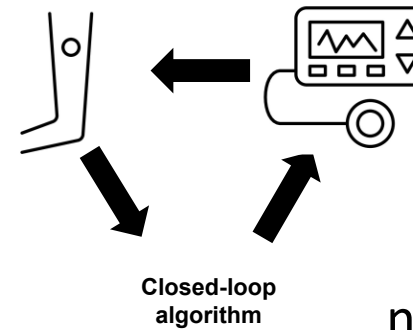
n=59

- ✓ 50% achieved TIRp 70%
- ✓ 3.7kg less weight gain
- ✓ LGA 39%

Lee T et al AiDAPT N Engl J Med 2023; 389:1566-1578

Off-label Commercial HCL

(Medtronic 780G (80%); Tandem Control IQ (10%);
Diabeloop (10%))

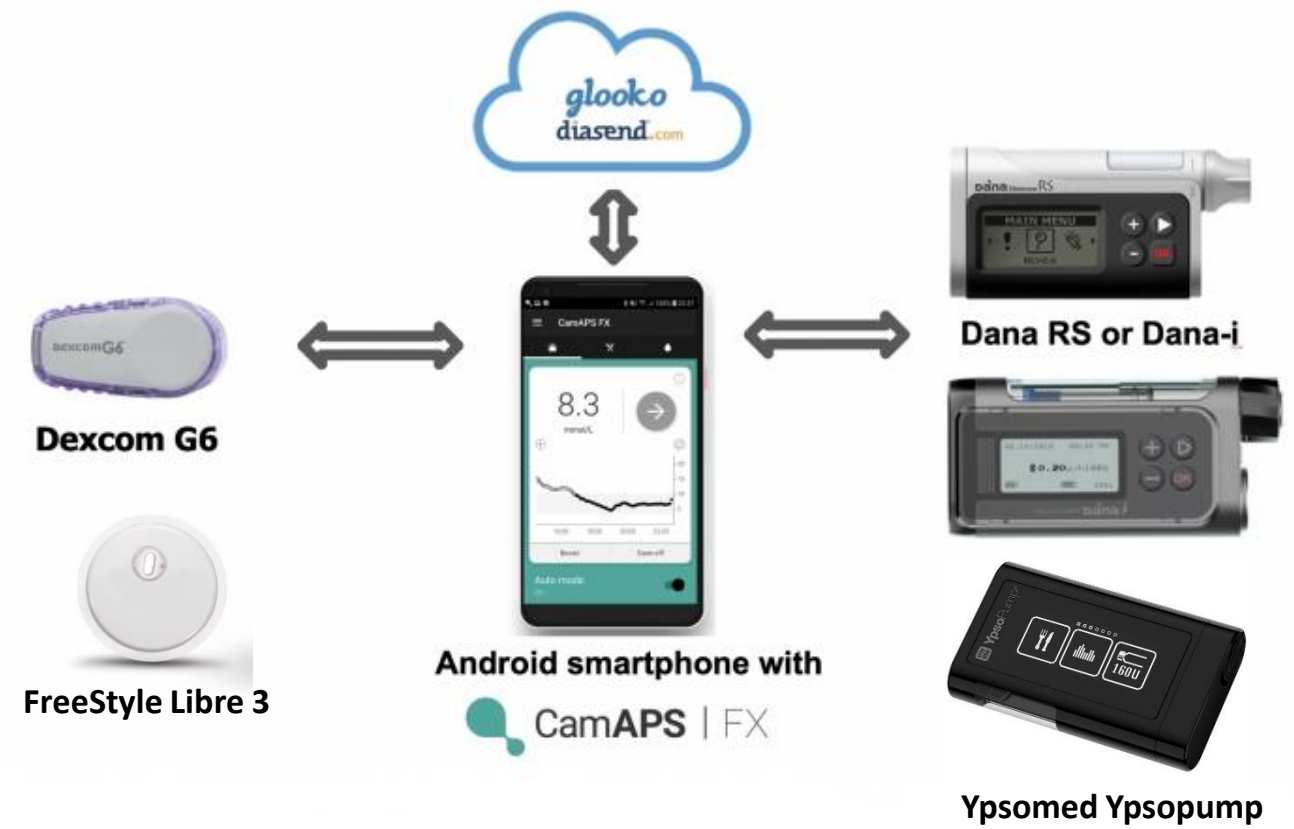


n=59

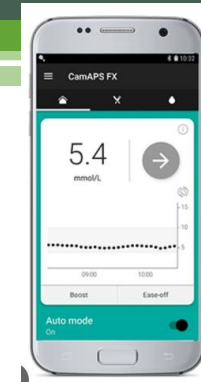
- ✗ 5% achieved TIRp 70% with HbA1c >6.5%
- ✗ 3.3-5.4 kg more weight gain
- ✗ LGA on HCL 69%

Quiros C et al Diabetes Technol Ther. 2024 Feb 28. Epub ahead of print;

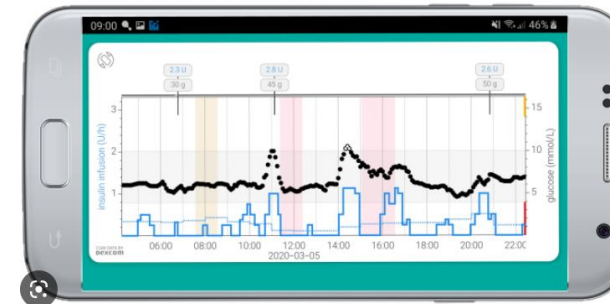
CamAPS-FX (CamDiab)

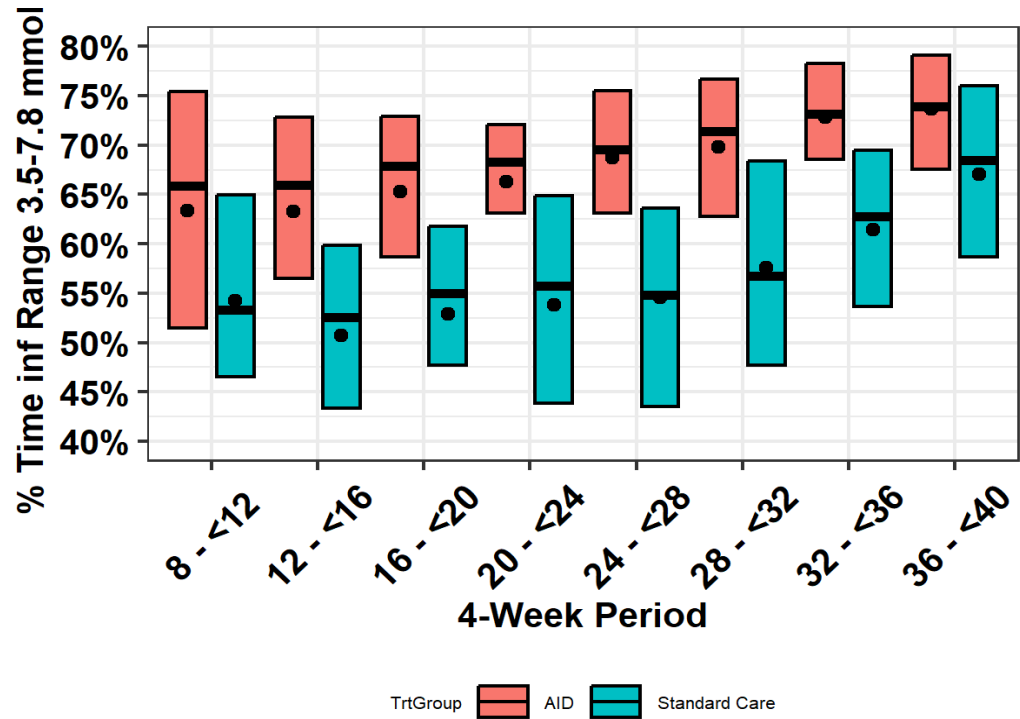


CAM APS FX

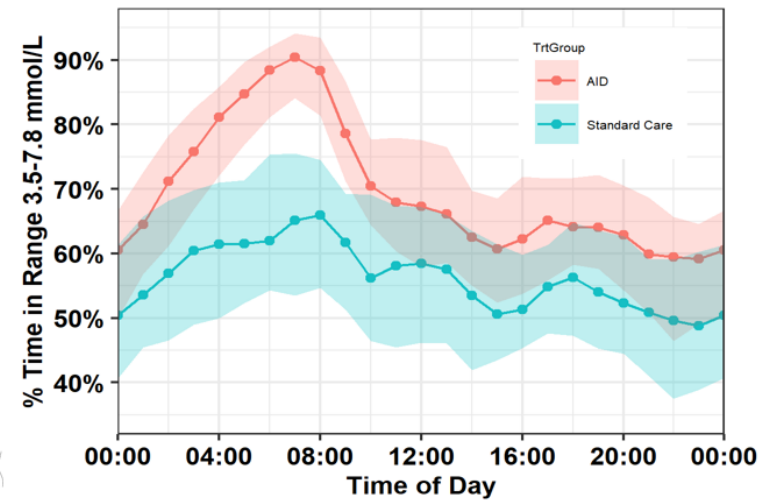


- CAM APS FX
 - Gradually reduce target glucose
 - Has biggest impact on how aggressive the system is - even 0.5 mmol/l
 - Pre pregnancy 5.8 mmol/l
 - 1st trimester 5.5 mmol/l
 - 2nd trimester (or earlier if hypo risk low) 4.5 – 5.0 mmol/l
 - **Remember hypo's more often caused by bolus**
 - Boost
 - **Post meal**
 - **Steroids**
 - Ease Off
 - Exercise
 - **Post hypo**
 - **Enter all carbs / including hypo treatment**



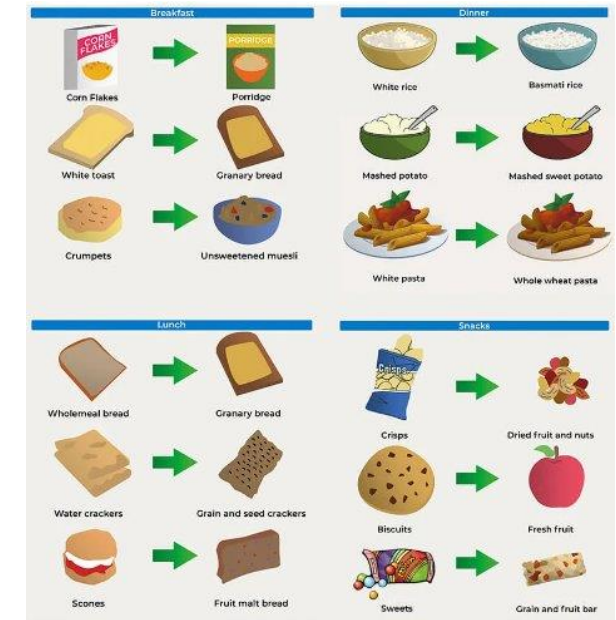


% TIR 3.5-7.8mmol/L (63-140 mg/dl) by time of day



CamAPS starts

- Early pregnancy start safe and beneficial
- Straight to insulin-using usual pump calculations
- Setting expectations:
 - **let system learn**
 - **Don't fiddle**
 - **No ghost carbs or corrections**
 - add carbs/hypo tx
 - timing bolus
 - diet (type / amount carbs)
- Safety netting
 - back-up pens and doses
 - Ketone meter + strips



Pre conception and pregnancy

Ypsopump CamAPS

Agreed to pump and consent for company		
Current pump/new		
Pregnancy/Pre Conception		
DAFNE HCL ESSENTIALS		
MDT agreed		
Funding		
CGM current /to change to		
Phone required y/n		
GP letter for pumpcart		
Pump ordered (hos/home)		
Sent training info		
Plan for current insulin regime		
Date for start		
Jot form		
Follow up		

DAFNE
Closed Loop Essentials course

- Type 1 diabetes ✓
- Living in UK, RoI, Crown Dependency ✓
- Non-DAFNE centre ✓
- Not attended DAFNE ✓
- WiFi connection, PC or tablet ✓

CamDiab

How does mylife CamAPS FX learn?

Never too late to benefit – 28/40 extra 15% > hypos

Average glucose 6.7 mmol/L	GMI 6.2 %	Time in Range 	Sensor usage Days with data 15/15 days Time active 100% Avg. calibrations per day 1.7
Standard deviation 2.3 mmol/L	Coefficient of Variation 33.7 %		

Target Range: 3.5-7.8 mmol/L

Glucose (CGM)

0% Very High > 13.9 mmol/L	GMI 6.1% (42.8 mmol/mol)
21% High 7.9-13.9 mmol/L	Average 6.4 mmol/L
77% Target Range 3.5-7.8 mmol/L	SD 1.7 mmol/L
1% Low 3-3.4 mmol/L	CV 26.8%
1% Very Low < 3 mmol/L	Median 6.2 mmol/L
	Highest 12.2 mmol/L
	Lowest 2.2 mmol/L

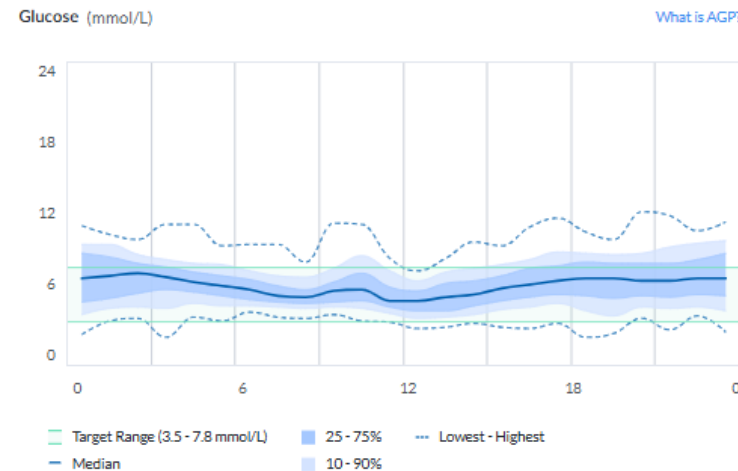
% Time CGM Active 93.1% (13 days)

Insulin - Device

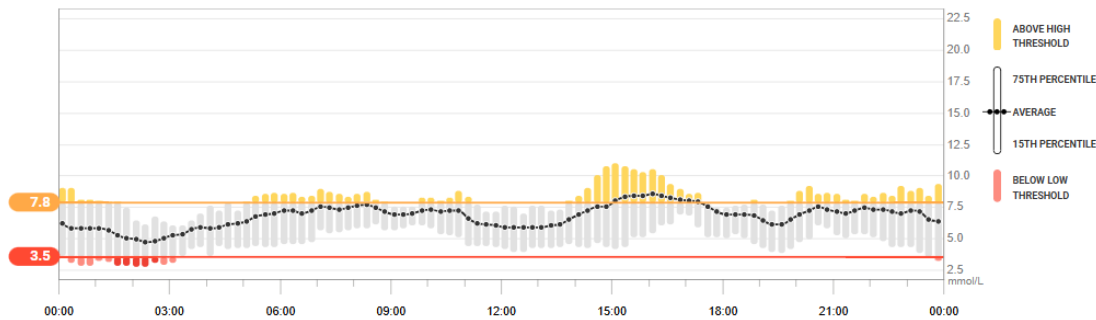
From Insulin Pump

Insulin/day	43.8 units
Overrides (%)	1% (1 boluses)
# Bolus/Day	6.8

AGP



This graph shows your data averaged over 15 days



System Details

CamAPS FX (13d)

Auto mode 'On'	97% (12d 16h)
Boost	23% (3d)
Ease-off	0%
Auto mode 'Off'	3% (8h)
Auto mode 'Attempting'	0%

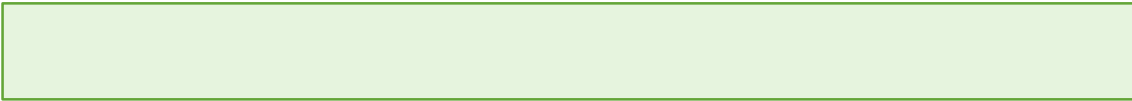
Diet

28 Feb - 13 Mar, 2025

179 g Carbs/Day	5.2 Entries/Day
-----------------	-----------------

Activity

MDI



WOW! The pump has been a game changer and removed so much of the burden of managing type 1 diabetes. Thank you for enabling this process.

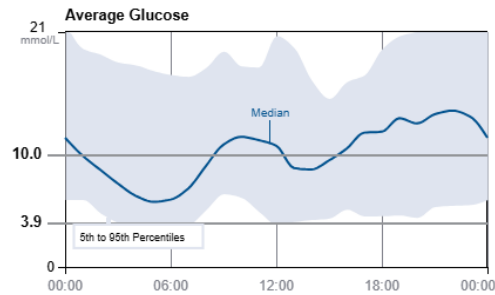
Snapshot

26 September 2024 - 9 October 2024 (14 Days)

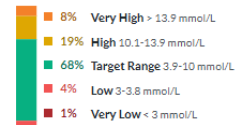
Glucose

GMI 7.9% or 63 mmol/mol

AVERAGE GLUCOSE	10.7 mmol/L
% above target	51 %
% in target	45 %
% below target	4 %



Glucose (CGM)



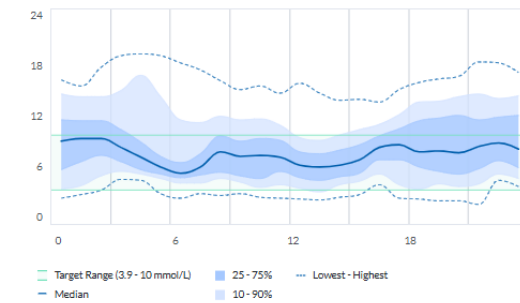
GMI	6.9% (51.8 mmol/mol)
Average	8.3 mmol/L
SD	3.3 mmol/L
CV	40.1%
Median	7.7 mmol/L
Highest	19.1 mmol/L
Lowest	2.2 mmol/L

% Time CGM Active 95.6% (13.4 days)

AGP

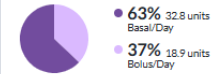
Glucose (mmol/L)

What is AGP?



Insulin - Device

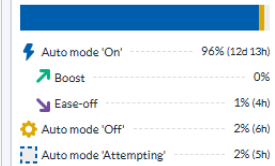
From Insulin Pump



Insulin/day	51.7 units
Overrides (%)	1% (1 boluses)
# Bolus/Day	9.6

System Details

CamAPS FX (13d)



Diet

22 Jan - 4 Feb, 2025

272.8 g Carbs/Day	7.3 Entries/Day
-------------------	-----------------

Activity

No activity data available

Omnipod Libre 2

GLUCOSE STATISTICS AND TARGETS

27 April 2024 - 10 May 2024

14 Days

Time sensor active:

87%

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

8.4 mmol/L

Glucose Management Indicator (GMI)

6.9% or 52 mmol/mol

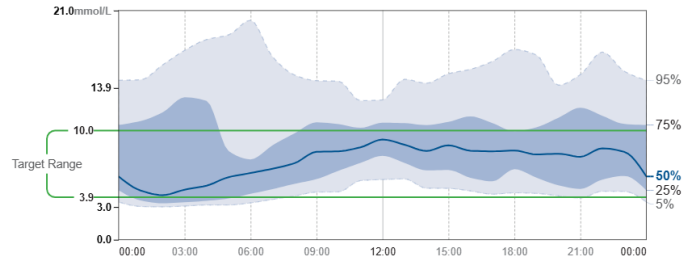
Glucose Variability

47.7%

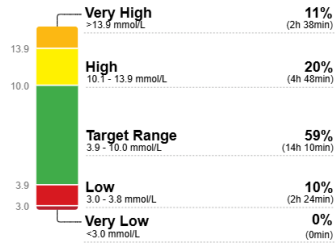
Defined as percent coefficient of variation (%CV); target ≤36%

AMBULATORY GLUCOSE PROFILE (AGP)

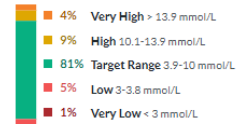
AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



TIME IN RANGES



Glucose (CGM)



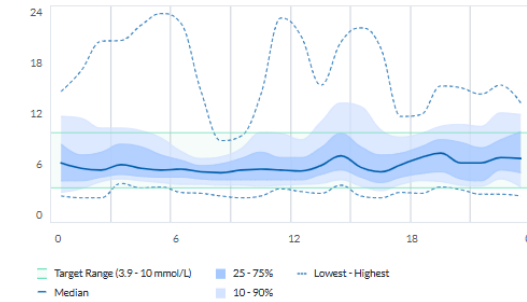
GMI		6.3% (45.6 mmol/mol)
Average		7 mmol/L
SD		3.2 mmol/L
CV		45.7%
Median		6.2 mmol/L
Highest		23.3 mmol/L
Lowest		2.7 mmol/L

% Time CGM Active 93.6% (13.1 days)

AGP

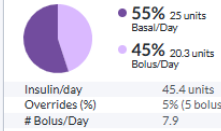
Glucose (mmol/L)

[What is AGP?](#)



Insulin - Device

From Insulin Pump



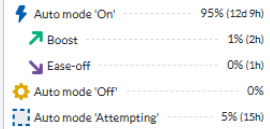
Insulin/day 45.4 units

Overrides (%) 5% (5 boluses)

Bolus/Day 7.9

System Details

CamAPS FX (13d)



Diet

22 Jan - 4 Feb, 2025

234.2 g Carbs/Day

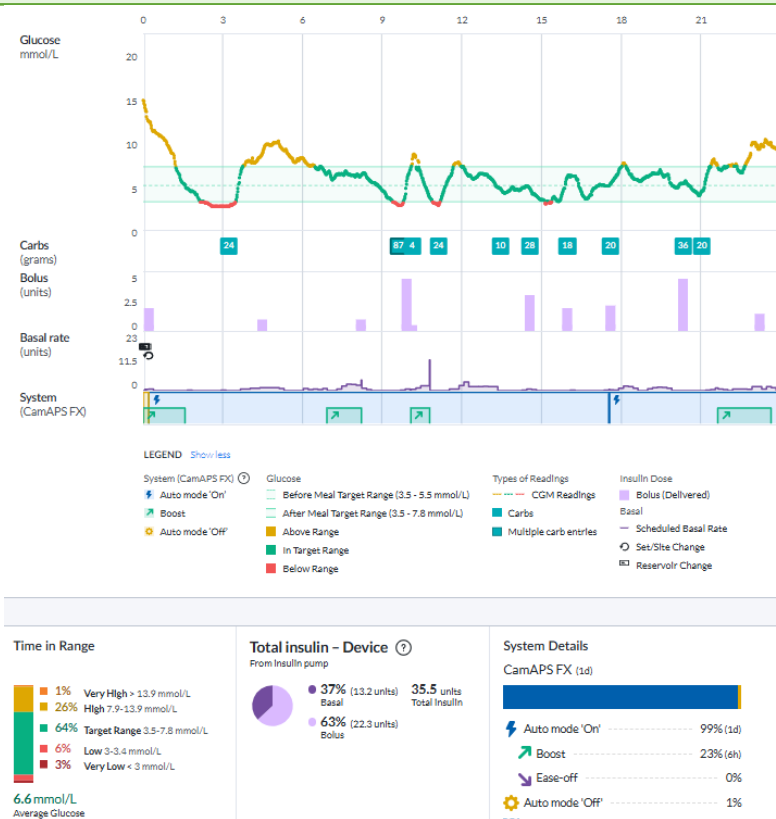
8.5 Entries/Day

Activity

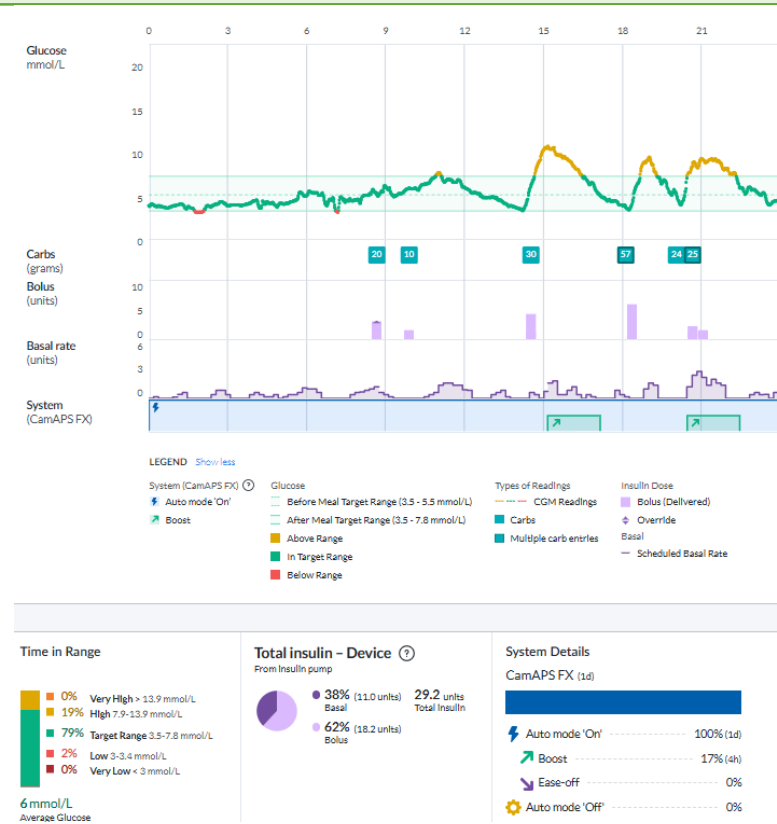
No activity data available

Let the system work

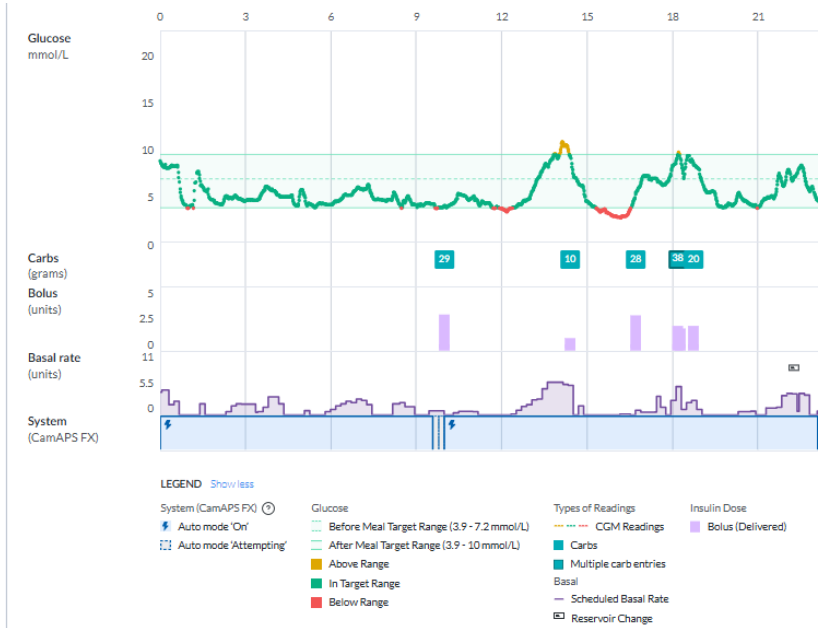
Ghost carbs



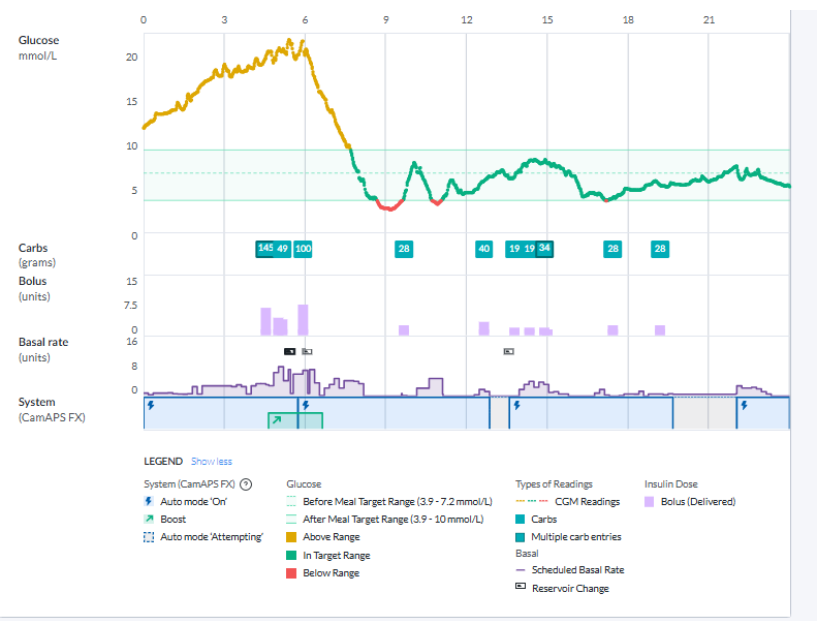
Use boost then change carb ratio

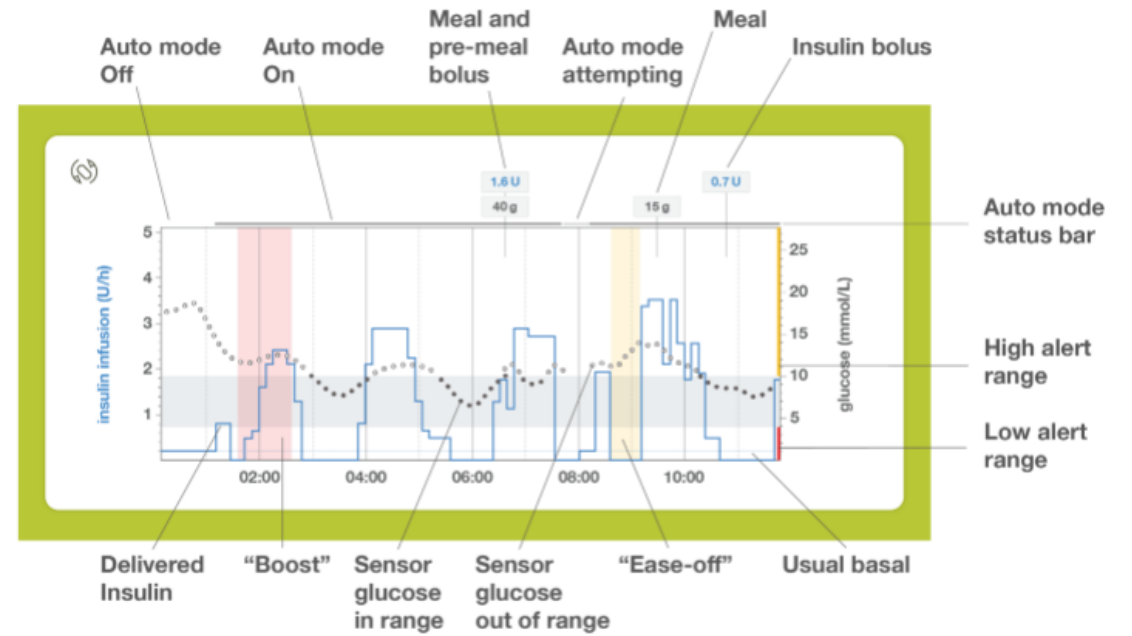
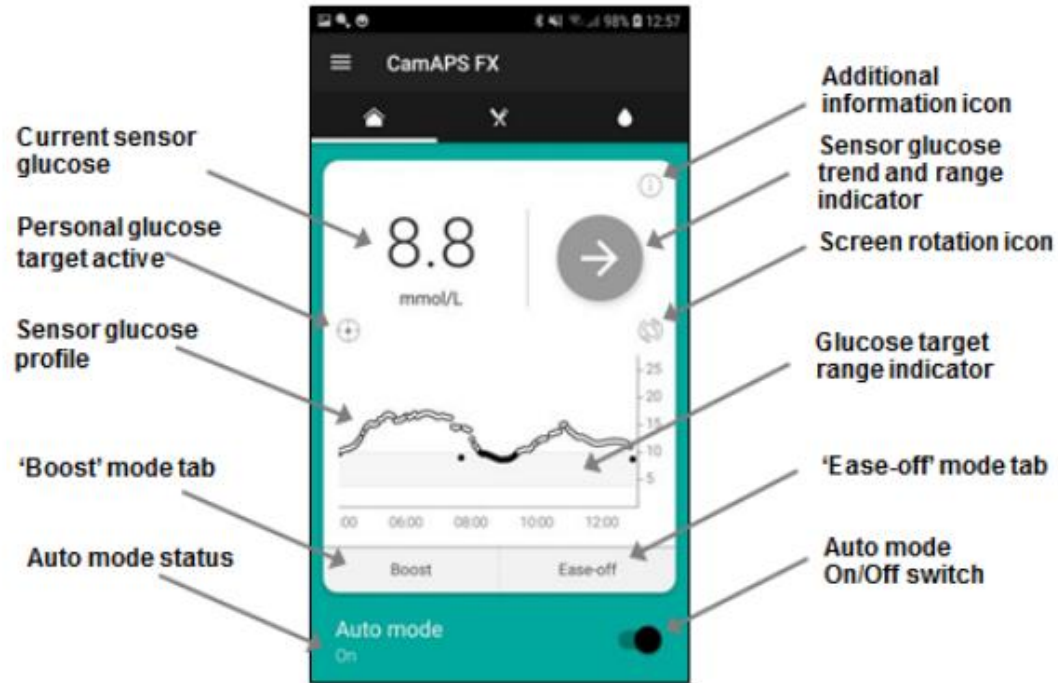


Add snack/not correction



Set issue





Delivery

HCL works well whilst women can manage

- Support from partner
- Use boost and ease off
- Bring plenty supplies
- HCL does better than VRIIi in normal circumstances
- If using VRIII must come out of closed loop

Post natal

- Immediate change
- Carb ratio (10-15g)
- Personal glucose target up 6 mmol/l
- Check back up rates
- Remember new target 3.9-10 mmol/l stress hypo avoidance with new baby

Post natal

THE LANCET
Diabetes & Endocrinology

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ARTICLES - [Online first](#), January 27, 2025 - [Open Access](#)

Automated insulin delivery during the first 6 months postpartum (AiDAPT): a prespecified extension study

Tara T M Lee, MBBS^{1,2*}, Corinne Collett, BSc³, Simon Bergford, MS⁴, Sara Hartnell, BSc⁴, Eleanor M Scott, MD¹, Robert S Lindsay, PhD⁵ et al. [Show more](#)

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>> Summary

Show Outline Background

Clinical guidelines in the UK and elsewhere do not specifically address hybrid closed loop (HCL) use in the postpartum period when the demands of caring for a newborn are paramount. Our aim was to evaluate the safety and efficacy of HCL use during the first 6 months postpartum compared with standard care.

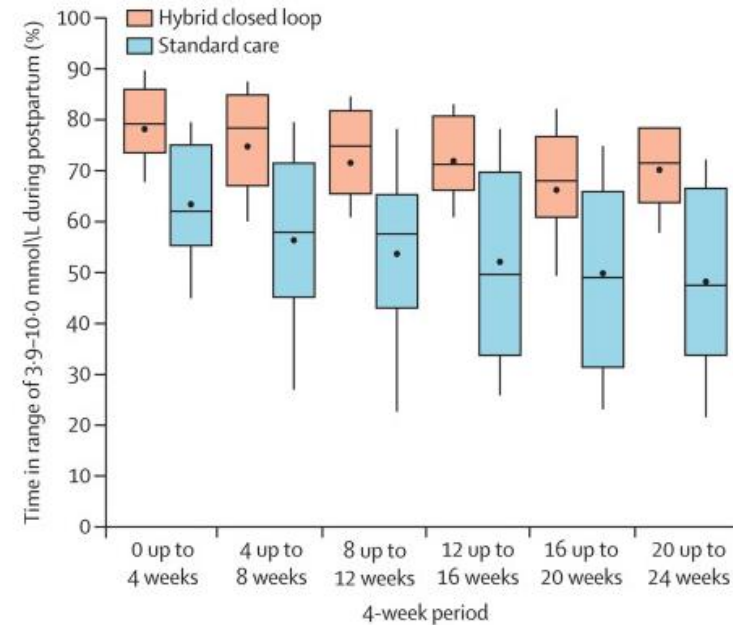


Figure 2 Time in target range during the 6 months postpartum

Benefits

Clinicians

- Less appointments
- Minimal changes to make(carb ratio /PGT)
- Able to focus app on other aspects
- Digital realtime uploading

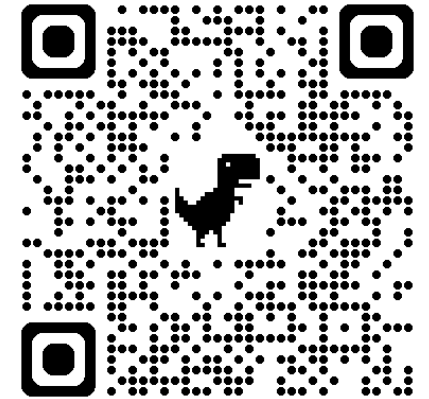
Patients

- Improved TIR
- Every 5% in range has clinical benefit for mother and baby
- Reduction in hypos
- Reduce burden of glucose management improvements to well being

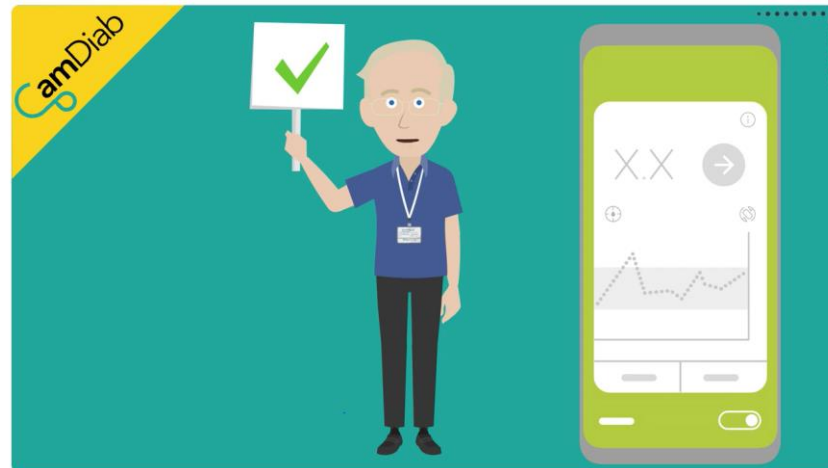
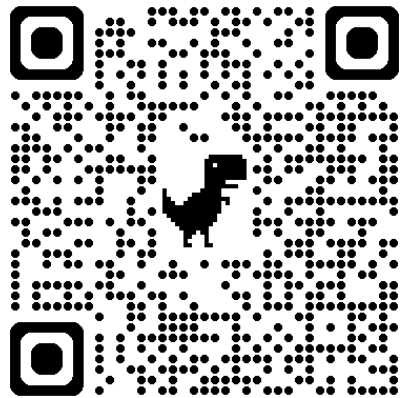


YouTube
Hybrid Closed-Loop (HCL) Therapy...

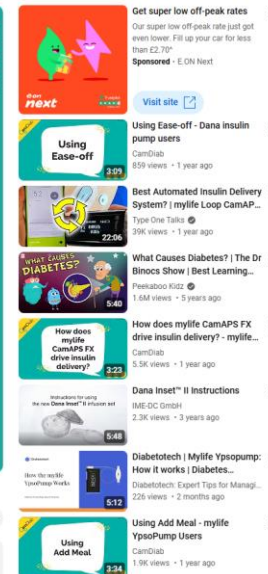
YouTube - CamAPS



- Ypsomed CamAPS optimisation course



How does mylife CamAPS FX learn? - mylife YpsoPump
CamDiab 741 subscribers
7.8K views 1 year ago
This short animation describes how the mylife CamAPS FX algorithm learns to match automated insulin delivery to an individual's unique requirements. ...more



BEST PRACTICE GUIDE:
Using diabetes technology in pregnancy