Tips for the use of hybrid closed-loop therapy from pre-conception to breastfeeding

We have had the privilege of being involved locally with the rollout of the NICE technical appraisal guidance recommendations on hybrid closed-loop (HCL) insulin delivery systems for those with type 1 diabetes who are pregnant or are planning to become pregnant (NICE, 2023). Much of our learning has been gained from attending conferences and workshops where there were expert speakers on the use of HCL or who were part of the AiDAPT trial (which evaluated the use of CamAPS FX systems in pregnant women with type 1 diabetes and postpartum [Lee et al, 2023]). This learning highlighted the importance of the ongoing use of HCL technology after the baby is born. The AiDAPT cohort randomised to use HCL therapy achieved a time in range (TIR) of 70% 6 months postnatally, compared to 50% TIR in the standard care cohort (Lee et al, 2025).

Here, we present our top tips for setting up and supporting people to use HCL therapy within a pre-conception and pregnancy service.

Referrals and first clinic appointment

Referrals to the nurse-led pre-conception clinic are made by colleagues from the wider diabetes specialist team. The first available appointment is conducted face-to-face or via telephone, usually within 4–6 weeks of referral. During this appointment, the following is discussed:

- The relationship between good glycaemic control and minimising the risks of pregnancy in someone with diabetes.
- The use of folic acid 5 mg/day.
- Discussion of HCL therapy with the use of the CamAPS FX system (currently the only HCL algorithm with a licence for pregnancy, following the AiDAPT study), including its benefits regardless of glycaemic control (e.g. improved quality of life and reduction of the everyday stresses of living with diabetes).

An email is sent following the appointment that includes the information discussed, alongside links to relevant resources.

If the person wishes to proceed with use of CamAPS FX, they are booked in for a start-up session within 3 months (2–6 weeks, if pregnant). If they wish to consider the information, a follow-up appointment is booked.

Set-up and ordering of consumables

A member of the administration team facilitates the relevant consumables order and liaises with the woman. Depending on staffing and group requirements, small and large groups are facilitated by the nursing and midwifery diabetes team alongside an industry representative.

The session is held towards the beginning of the working week to ensure that we are contactable during office hours for support in the first few days. A mobile number, as well as the Diabetes Nurse Helpline number, is provided. Pump companies also provide a 24-hour helpline.

Setting the HCL and pump settings

It is the responsibility of the healthcare professional (HCP) to produce appropriate and individualised pump settings, including:

- Basal profile (for manual mode, normally flat basal).
- Personal glucose target (range 4.4–11.0 mmol/L).
- Insulin to carbohydrate ratio.
- Correction/sensitivity factor.
- Duration of insulin action.
- Supporting users to input "meal sizes" in the pre-set carbohydrate value feature.

These settings are devised in accordance with guidance based on weight or total daily insulin dose (ABCD and DTN-UK, 2018). If someone often misses bolus doses, we use weight (0.5 units/kg in line with this guidance) over total daily dose.

Cathy Jones
Diabetes Technology Specialist Midwife, Leicester Diabetes Centre and University Hospitals of Leicester NHS Trust

Grace Grudgings
Diabetes Specialist Nurse, University Hospitals of Leicester NHS Trust

Citation: Jones C, Grudgings G (2025) Tips for the use of hybrid closed-loop therapy from pre-conception to breastfeeding. *Journal of Diabetes Nursing* [Early view publication]

"Taking an individualised approach to setting glucose targets is key to success for the hybrid closed-loop user."

Safety messages

The key topics covered by the HCP are:

- HCL sick-day rules guidance (including set failures). An information sheet is available for this (ABCD and DTN-UK, 2023).
- Hypoglycaemia treatment, which differs to that for multiple daily injection therapy.
- Ensuring emergency supplies are available (e.g. "back-up" insulin pens).

Follow-up

Success and confidence in using HCL systems relies on input from both the user and the HCP. After initiation of HCL, we offer face-to-face or virtual support the following week and after one month, as standard. Some people require more input than this and we facilitate this through the nurse/midwife-led clinic. Those who are pregnant receive two-weekly reviews, in line with guidance.

At the one-week follow-up, clinicians can address any concerns, questions or teething problems, and provide refreshers for any information that may have been missed or forgotten. Anecdotally, we find that announcing hypoglycaemia treatment or slowly absorbed meal (e.g. a higher fat and protein meal) through the "Add Meal" feature are some things that often need prompting.

Further reviews provide the opportunity to re-balance and optimise the pump settings based on the pump data made accessible via the Glooko data-viewing platform.

Women continue to receive support through the pre-conception service on a 3–4-monthly basis, as required, until their care is taken over by the antenatal team when they become pregnant. For women who are consistently achieving >70% TIR, a patient-initiated follow-up (PIFU) arrangement is offered (as well as regular follow-up), so that they can book an appointment for further support, if they wish. They are seen at the consultant pre-conception clinic 4–6 monthly.

Personal glucose targets

Taking an individualised approach to setting glucose targets is key to success for the HCL user. Before setting a personal glucose target (PGT), look at what the time in range is and discuss settings with a prescriber or diabetes doctor who is skilled in setting insulin pump rates. If someone is commenced on HCL and has been performing capillary blood glucose monitoring over continuous glucose monitoring, review glucose levels prior to confirming settings.

If someone is used to running with a higher average glucose level, they may not tolerate a lower PGT, as they may feel hypoglycaemia at higher levels. CamAPS FX provides a wide range of targets in 0.1 mmol/L increments to cover all bases and scenarios.

When a user changes their PGT, check it is this that is being altered. Changing the glucose target within the bolus calculator section of the app will have no impact.

If a user is already pregnant, there is less time to gradually reduce glucose targets and a more intensive approach from the multidisciplinary team is required.

Pre-existing retinopathy

Diabetes retinopathy screening should occur during each trimester of pregnancy to detect any changes and ensure those who require treatment are seen promptly. When someone has retinopathy (more than background) and is currently receiving treatment, discuss this with ophthalmology. This may require a delay in HCL start or a higher target to be set. Conversations between a diabetes consultant and consultant ophthalmologist are needed for the best outcome for the person with diabetes.

Pre-conception to baby

Pre-conception

Manage the system as you would for other available HCL systems, aiming to achieve ≥70% TIR at 3.9–10 mmol/L.

Trimester 1

Early pregnancy often brings nausea and vomiting, alongside tiredness. This can be a particularly difficult time for managing glucose levels, in particular with carbohydrate counting and bolusing. If nausea and vomiting is an issue, delivering some of the bolus up front followed by use of the slowly absorbed meal function, or giving remaining bolus at the point of eating the rest of the meal, can help to reduce the risk of post-meal hypoglycaemia.

Adjustments within the CamAPS FX app during pregnancy and postnatally.

Trimester 1	Trimesters 2 and 3	Postnatal
• Weight (kg) • Personal glucose target ≤5.5 mmol/L* • Insulin to carbohydrate ratio • Basal rates, as required (no impact to algorithm, only when in manual mode) • Consider ultra-rapid-acting insulin, if not already using†	• Weight (kg) minimum 4 weekly • Personal glucose target ≤5 mmol/L* • Insulin to carbohydrate ratio • Active insulin time (3–4 hours) • Insulin sensitivity factor/correction factor (doesn't impact algorithm) • Use of Boost function post meals • Basal rates, as required (no impact to algorithm, only when in manual mode) • Consider ultra-rapid-acting insulin	• Weight (set to booking weight or postnatal weight if weighed in kg) • Personal glucose target ≥6 mmol/L • Insulin to carbohydrate ratio • Switch to Basal B. This may be programmed at antenatal clinic or pre-pregnancy, and will be a reduced basal rate compared to pregnancy • Insulin sensitivity factor/ Correction factor • Use of Ease-off function (particularly with breastfeeding)
• Cannula site rotation and pre-bolusing are important at all times		

*Target may need to be individualised depending on holistic clinical scenario (e.g. high % time below range).
†Nwokolo et al (2023).

Trimester 2

During this trimester, insulin resistance is increasing, so insulin requirements are likely to go up. Often, women are starting to feel a little better and have some more energy, with most being back to their normal pattern of eating.

Trimester 3

Insulin resistance increases rapidly during the third trimester. Post-meal hyperglycaemia can be common, bringing rapidly increasing insulin requirements. Conduct virtual reviews of HCL every 1–2 weeks in between 4-weekly face-to-face appointments to support women with type 1 diabetes during this stage.

Postnatal

Once baby and placenta are delivered, there is an immediate drop in insulin requirement. It is important that settings are changed as soon as possible after the birth of the baby or prior to elective caesarean section. We set these at around 32 weeks in case of preterm delivery or emergency admission, and revisit them again at 36 weeks (adjusting where required).

Steroids

Each NHS trust will have its own policy and recommendations for care during steroid administration with diabetes.

Within our local trust to date, no women using HCL have required variable rate intravenous insulin infusion (VRIII) following administration of steroids. Instead, the "Boost" mode has been used and adjustments to bolus doses made by women, as required.

Checking for blood ketones is very important if glucose levels are elevated (in line with local policies).

Labour and caesarean section

During labour and caesarean section, women have continued to wear the HCL system (using a Teflon cannula). They were advised at clinic to wear their

"Early pregnancy often brings nausea and vomiting, alongside tiredness. This can be a particularly difficult time for managing glucose levels, in particular with carbohydrate counting and bolusing."

"During labour and caesarean section, women have continued to wear the HCL system."

sensor on an arm and their cannula on the upper abdomen or back, where possible, to avoid their potential removal for emergency C-section. A clear, documented plan is provided on electronic and handheld medical notes via an HCL passport.

Prior to elective C-section, change to the postnatal settings to help reduce the risk of hypoglycaemia postnatally.

For those using HCL during labour, it is important that the mother-to-be or their birthing partner manages the HCL system. This is not the responsibility of the midwifery staff.

Change to postnatal settings as soon as possible after the baby is born.

Breastfeeding

Often, women report an increase in hypos or needing to snack while breastfeeding. The use of the "Ease-off" mode may help, or a higher PGT can be set to help reduce hypoglycaemia, if this is an issue. Hypoglycaemia rates are low postnatally with the use of HCL (Lee et al, 2025).

Conclusion

This is our real-world experience of using the CamAPS FX HCL system. HCL works well for women during pregnancy and postpartum, with improved outcomes as shown by the AiDAPT study. NHS England has provided a pregnancy switch fund, so that pregnant women with diabetes can use the licensed system to help improve outcomes of pregnancy. As HCPs, it is important that we provide women with the right settings and support to use the CamAPS FX system effectively, while working alongside supporting staff who are not within a diabetes specialist roles. ■

Association of British Clinical Diabetologists (ABCD), Diabetes Technology Network UK (DTN-UK) (2018) *Best Practice Guide: Continuous subcutaneous insulin infusion (CSII). A clinical guide for adult diabetes services*. Available at: https://abcd.care/sites/default/files/BP_DTN_v13%20FINAL.pdf (accessed 13.02.25)

ABCD, DTN-UK (2023) *Hybrid closed loop (HCL) system: Information leaflet*. Available at: https://abcd.care/dtn/resource/current/hybrid-closed-loop-hcl-system-information-leaflet (accessed 13.02.25)

ABCD, DTN-UK (2025) *Hybrid closed loops (HCL) educational videos*. Available at: https://abcd.care/dtn-education/hybrid-closed-loops (accessed 13.02.25)

Lee TTM, Collett C, Bergford S et al; AiDAPT Collaborative Group (2023) Automated insulin delivery in women with pregnancy complicated by type 1 diabetes. *N Engl J Med* **389**: 1566–78

Lee TTM, Collett C, Bergford S et al; AiDAPT Collaborative Group (2025) Automated Insulin Delivery during the first 6 months postpartum (AiDAPT): a prespecified extension study. *Lancet Diabetes Endocrinol* 27 Jan [Epub ahead of print]

NICE (2023) *Hybrid closed loop systems for managing blood glucose levels in type 1 diabetes* (TA943). Available at: https://www.nice.org.uk/guidance/ta943 (accessed 13.02.25)

Nwokolo M, Lakshman R, Hartnell S et al (2023) CamAPS FX Hybrid Closed-Loop with Ultra-Rapid Lispro Compared with Standard Lispro in Adults with Type 1 Diabetes: A Double-Blind, Randomized, Crossover Study. *Diabetes Technol Ther* **25**: 856–63