AID-IRL

(Automated Insulin Delivery In Real Life)

@DanaMLewis
Study aim:

• A qualitative deep dive into the real-world impact of commercial automated insulin delivery systems.

Methods:

• Semi-structured phone interviews with 7 users of commercial AID systems

  • 4 Control-IQ users; 2 670G users; 1 CamAPS FX user
  • Mix of longer time users and newer users
  • Participants received $50 via Paypal or Amazon gift card

Note: This study was funded by DiabetesMine

@DanaMLewis
Control-IQ by Tandem
Available since January 2020 in US

670G by Medtronic
Available since 2018 in US

CamAPS FX by CamDiab
Not available in US (app used with DANA*RS pump by SOOIL, recently available in UK)

@DanaMLewis
improved, or no issues

no change, satisfactory or neutral

negative impact or experience

- training/learning curve
- TIR
- hypo
- QOL
- sleep impact
- troubleshooting
- expectations met

@DanaMLewis
1 – Control-IQ

- **Parent of child with T1D** (4+ years on pump/CGM), previous experience in ‘littles’ study on Control-IQ, currently using off-label
- TIR – 30% increase, no change to hypos (3% <70)
- Less aggressive corrections needed – usually meal-related
- minimal troubleshooting, but referenced having ‘solid’ settings

@DanaMLewis
1 – Control-IQ (continued)

• QOL general: “It’s been huge. I feel like in 90 days, I thought about diabetes less than any other time in 3.5 years.”

• Sleep: “It’s huge. We get solid sleep, uninterrupted sleep for the first time since diagnosis.”

• Frustrated by:
  • lack of remote bolusing, remote monitoring on phone
  • 2 hour warmup on CGM
  • doesn’t deal well with underestimated meals (but ok with growth spurt hormones)
2 – Control-IQ

- **Adult male T1D**, previous experience for several years with a DIYAPS (including unannounced meals), longtime pump & CGM user

- TIR – 5-10% decrease from DIYAPS usage
  - *(on par with other commercial users’ TIR averages)*

- Pleased with ease of use/convenience factor of non-DIY solution

- “Just me and my pump, and I love that. It’s awesome. I feel like that’s what I wanted for so long. It’s supremely good - except for the stats *(decreased TIR).*”
2 – Control-IQ (continued)

• Frustrated by:
  • post-meal highs - **stopped eating breakfast**
  • lack of ‘learning’ – e.g. high for a week when sick
  • requires more manual interventions
  • 2 hour warmup on CGM

• “With DIY, I could tweak and make things better and achieve 5% better. With Control-IQ, I can’t.”

@DanaMLewis
5 – Control-IQ

- Adult female with LADA, previously on Basal-IQ
- Did not like at first and turned it off after 2 weeks; restarted after a month pause with more aggressive settings
- Same TIR as Basal-IQ.
  - Does not bolus or enter carbs (due to making own insulin)
  - It took ‘artificially inflating settings to 2x carb ratio, 2x stronger ISF, and 3x basal rates’ to achieve the similar TIR.

@DanaMLewis
5 – Control-IQ (continued)

• Peace of mind with system: sleeps better knowing it is preventing hypo’s

• Frustrated by:
  • Hard coded target (‘too high’) and lack of flexibility around achieving goal BG levels
  • Not having low glucose suspend active to ward off lows if Control-IQ turned off
  • How aggressive settings need to be
  • Lack of information on how much basal insulin is being/has been dosed each hour – retrospectively hard to find if not looking at the screen

@DanaMLewis
7 – Control-IQ

• **Adult female** with T1D, 2 years with pump and CGM.
  • Frequently takes steroids, which increase BGs
• More TIR at night (70% increase in TIR overall), no additional lows
• “It does a decent job keeping up” with steroid-induced highs
• Does not manually set high temps/correct as often
7 – Control-IQ (continued)

• **Frustrated by:**
  
  • Set target – wants to run ‘tighter’
  
  • Unable to get boluses in sleep mode, so never runs sleep mode to get more corrections

• “I don’t use sleep mode because it doesn’t use boluses, and it doesn’t work for dawn phenomenon.”
3 – 670G

- Adult male T1D, 1 year of CGM before switching to CGM+pump (3mo) then 670G (last 3 years)
- No observed change to A1c/not aware of TIR changes
- Pleased with ability to handle activity/exercise with automode and activity target
- Learning curve was ‘easy’ – if you already understood CGM calibration

@DanaMLewis
3 – 670G (continued)

- **Frustrated by:**
  - post-meal highs, especially if missed/delayed bolus or underestimated carbs
  - CGM calibration – fingersticks, woken up overnight 1-2x a week to calibrate, issues 3x/week
  - not having low glucose suspend active to ward off lows if kicked out of automode
  - requires more manual interventions
  - CGM transmitter charging
6 – 670G

- **Adult male**, originally diagnosed T2 but treated aggressively with insulin; now considered T1. 5 years on pump; first CGM was used alongside 670G (last few months).
  - Increased TIR with less hypo, and **decreased TDD**
    - Did not have to adjust settings despite TDD decreased
  - Learning curve was ‘easy’, previous pump experience (despite lack of CGM) gave confidence

@DanaMLewis
6 – 670G (continued)

• **Frustrated by:**
  • Virtual training (due to COVID-19; would have preferred in person with trainer)
  • **Alarms/alert frequency** – has to clear 4-5 off the screen per day
  • **Woken up every other night** – BG alarm or calibration required
  • Warm up time and charging transmitter (takes another – 1.5h to charge on top of 2h warmup)
  • Keeping pump near transmitter on the same side of the body
4 – CamAPS FX

• **Adult male T1D**, 5 years on pump/CGM, previous DIYAPS user with no-carb-announce meals

• No observed change to TIR compared to DIYAPS

• Learning curve was ‘easy’ – but “it has to learn you and you have to learn it”.

• Has features that achieve similar outcomes to DIYAPS-based temporary targets, but misses ability to schedule in advance.

@DanaMLewis
4 – CamAPS FX (continued)

• Frustrated by:
  • "Too much" hypoglycemia – 7% (<70 mg/dL), which is almost 2x DIYAPS hypos.
  • Lack of visibility to IOB; IOB not visible outside of mealtimes. makes exercise challenging without IOB knowledge.
  • Learning model of system works better for people with a regular routine
  • Alarms would impact sleep if wasn’t using a second phone for better alarms

@DanaMLewis
**Universal themes**

- Increased (or same) TIR
- Some reduced hypos; some systems increase hypos
- Post-meal highs were commonly mentioned by 670G & Control-IQ users

<table>
<thead>
<tr>
<th></th>
<th>Control-IQ</th>
<th>670G</th>
<th>CamAPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>training/learning curve</td>
<td>✔️ ✔️ ✗ ✔️</td>
<td>✔️ ✔️ ✔️</td>
<td>✔️ ✔️ ✔️</td>
</tr>
<tr>
<td>TIR</td>
<td>✔️ ✗ ✔️ ✔️</td>
<td>✔️ ✔️ ✔️</td>
<td>✔️ ✔️ ✔️</td>
</tr>
<tr>
<td>hypo</td>
<td>✔️ ✔️ ✔️ ✔️</td>
<td>✔️ ✔️ ✗ ✔️</td>
<td>✔️ ✔️ ✗ ✔️</td>
</tr>
<tr>
<td>QOL</td>
<td>✔️ ✔️ ✔️ ✔️</td>
<td>✔️ ✔️ ✔️ ✔️</td>
<td>✔️ ✔️ ✔️ ✔️</td>
</tr>
<tr>
<td>sleep impact</td>
<td>✔️ ✔️ ✔️ ✗</td>
<td>✔️ ✔️ ✗ ✗</td>
<td>✔️ ✔️ ✗ ✗</td>
</tr>
<tr>
<td>troubleshooting</td>
<td>✔️ ✔️ ✔️ ✔️</td>
<td>✔️ ✔️ ✗ ✔️</td>
<td>✔️ ✔️ ✔️ ✔️</td>
</tr>
<tr>
<td>expectations met</td>
<td>✔️ ✔️ ✔️ ✔️</td>
<td>✔️ ✔️ ✔️ ✔️</td>
<td>✔️ ✔️ ✔️ ✔️</td>
</tr>
</tbody>
</table>

@DanaMLewis
## Universal themes

- New CGM users have a more noticeable learning curve; more likely to comment on alarms/alerts.

- 670G users more likely to mention connection issues and CGM calibration issues, both of which impacted sleep.

<table>
<thead>
<tr>
<th></th>
<th>Control-IQ</th>
<th>670G</th>
<th>CamAPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>training/learning curve</td>
<td>✓ ✓ X ✓</td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>TIR</td>
<td>✓ X ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>hypo</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ X</td>
<td>✓ X X X</td>
</tr>
<tr>
<td>QOL</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>sleep impact</td>
<td>✓ ✓ ✓ ✓ X X</td>
<td>✓ ✓ X X</td>
<td>✓ ✓ X X</td>
</tr>
<tr>
<td>troubleshooting</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>expectations met</td>
<td>✓ ✓ ✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
</tbody>
</table>

- ✅: Improved, or no issues
- 🟢: No change, satisfactory or neutral
- ❌: Negative impact or experience

@DanaMLewis
Newer AID users:

- **1** - Eased by "lurking" in DIY community (despite not using DIY) and previous 5-day study experience
- **5** - Felt learning curve was ‘high’.
- **6** - Previous pump experience helped, but struggled with CGM

<table>
<thead>
<tr>
<th></th>
<th>Control-IQ</th>
<th>670G</th>
<th>CamAPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>training/learning curve</td>
<td>✔️</td>
<td>❌</td>
<td>✔️</td>
</tr>
<tr>
<td>TIR</td>
<td>✔️</td>
<td>❌</td>
<td>✔️</td>
</tr>
<tr>
<td>hypo</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>QOL</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>sleep impact</td>
<td>✔️</td>
<td>✔️</td>
<td>❌</td>
</tr>
<tr>
<td>troubleshooting</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>expectations met</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
</tbody>
</table>

- ✔️ improved, or no issues
- ❌ no change, satisfactory or neutral
- X negative impact or experience

@DanaMLewis
### Previous DIY users:

Both referenced convenience factor of commercial system.

- **2** - “With DIY [OpenAPS] I felt like I could eat breakfast.”
- **4** - “I was quite surprised at how well it performed.”

<table>
<thead>
<tr>
<th>Feature</th>
<th>Control-IQ</th>
<th>670G</th>
<th>CamAPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>training/learning curve</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>TIR</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>hypo</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>QOL</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>sleep impact</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>troubleshooting</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>expectations met</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

- ✔: improved, or no issues
- ✓: no change, satisfactory or neutral
- X: negative impact or experience

@DanaMLewis
Take note, companies:

• Different onboarding based on prior diabetes tech may be useful.
• Most users wanted better displays of IOB, temporary/adjustable targets
• Enabling hypo protection even if high correction is disabled
• Post-prandial needs further improvements
• Remote bolusing is highly desired – as is remote monitoring

@DanaMLewis
Discussion items

• Many users with ‘ideal’ TIR are still doing frequent (2-3x/day) manual corrections outside of mealtimes with commercial hybrid closed loop technology

• Newer CGM users (1 year or less) seem to have their own learning curve adapting to CGM calibration, data availability, alerts/alarms

@DanaMLewis
Limitations of AID-IRL study

- Recruited participants via social media (primarily Twitter and Instagram) who had publicly shared about commercial AID use
- Attempted to get a mix of new/longer users, but this is also biased by availability timeline of commercial systems
- Participant bias: recall and recency
- Status quo bias
  - insurance and HC makes it hard to switch to try something else
  - only DIY users have had access to try multiple systems

@DanaMLewis
Questions about AID-IRL?

Ask the panelists
(use Q&A feature)
or ask me on Twitter
@DanaMLewis!

@DanaMLewis | www.DIYPS.org | www.OpenAPS.org | www.CoEpi.org

Thanks to DiabetesMine for AID-IRL study funding.