

Type 1 diabetes, DKA and insulin pump use without CGM

Optimal management of Type 1 diabetes carries a heavy burden but with access to appropriate expert diabetes advice, insulin and frequent glucose testing (finger-poke sugar testing & CGM), and compliance with insulin administration and frequent glucose testing, DKA should never occur. DKA therefore reflects system failure. In Canada the commonest point of failure is at the level of the client/patient - clients simply do not administer appropriate doses of insulin. The administration of appropriate doses of insulin requires frequent glucose testing. Ultimately the commonest cause of DKA is therefore failure to test glucose frequently and to act on the results.

If an individual with Type 1 diabetes feels unwell, particularly if their glucose is >15 mmol/L, they should start [sick-day management](http://bit.ly/2Y3peJq) (see <http://bit.ly/2Y3peJq>) to prevent the development of DKA. Sick day management is taught to all individuals with Type 1 diabetes at my clinic, and in one form or another is part of Good Clinical Practice (GCP) recognized by every specialist diabetes clinic worldwide. Sick day management mode demands hourly testing of glucose, consideration of administration of additional rapid insulin if glucose is > 11 mmol/L and consumption of salty liquids. If a patient cannot keep fluids down, they should go immediately to the Emergency room.

In my experience of treating DKA in hospital, and managing patients at BCDiabetes after being discharged from hospital with DKA, more than 90% were ultimately caused by insulin non-compliance. Indeed, some insulin pumpers try to save face by initially blaming “pump failure,” citing blocked cannulas/kinked tubing, etc, when this was not the truth. By insulin non-compliance, I mean that insufficient insulin was administered by the client.. The commonest cause of insufficient insulin being administered is insufficient finger-poking. In other words, most DKA is caused by diabetes neglect and failure to practice diabetes due diligence. Individuals who either use CGM or finger-poke frequently develop DKA much less frequently, and if they develop DKA it is typically mild and they are discharged from hospital within 24-48 hours of admission. Regardless of whether CGM or finger-poke is being used, the vast majority of potential DKAs can be avoided by adopting [sick day management](#) as soon as glucose levels rise.

Hanas’s group in Sweden using national pediatric statistics in both [2009](#) (see <https://bit.ly/Sweden2009>) and [2022](#) (see <https://bit.ly/Sweden-2022>) has shown that the primary cause of DKA with pump use to be insulin non-compliance (missing insulin doses etc.) rather than any device issues. Because insulin pumps provide insulin on a minute-to-minute basis, and do not feature an injected reservoir of basal insulin seen with MDI, without diligence, DKA can develop more quickly in pump users than those using MDI.

In 2020 [Flores and colleagues](#) see <https://bit.ly/2020USAya> from the Cleveland Clinic showed that the most common precipitating factor for developing DKA was insulin non-adherence. The authors noted “Based on our questionnaire, most of the patients had been using insulin pumps for at least 5 years, 75% knew about their settings, and 76% recognized malfunction. These data are less suggestive of a lack of expertise but instead the problem seems to rely on the lack of knowledge regarding further actions after recognizing a pump malfunction”. The authors concluded “Despite non-adherence being common... a combination of social factors, education and insulin pump malfunction, such as pump/tubing problems, might be playing a

pivotal role in DKA etiology in young adults with T1DM, especially in pump users.”

In 2022, [Doyle and coworkers from Yale University](https://bit.ly/DKAPrevention) (see <https://bit.ly/DKAPrevention>) authored a paper “DKA Prevention and Insulin Pumps: Lessons Learned From a Large Pediatric Pump Practice” - their conclusion was that “DKA events in pump-treated patients were relatively uncommon; most episodes occurred in adolescents with higher A1C levels, and notably, most events could have been avoided if users followed standard troubleshooting guidelines. Thus, DKA prevention education should be reinforced at each encounter, particularly for teens with higher A1C levels. Moreover, more than 50% of those with DKA episodes wore a CGM, suggesting that pump users using CGM require frequent reinforcement of this education and that the development of such educational materials is critical.”

My own belief is that the “social factors” mentioned by Flores and colleagues reflected an historic misconception by insulin pump users that they could “set and forget” about their pump, when used without CGM/automation, and with insufficient finger-poking, such that magically their pump would “take care” of their T1D. Thus some pumpers were imbued with a false sense of security, inconsistent with the manufacturer’s instructions. And because pump users, by virtue of the high upfront and running cost of pump usage, were pre-selected as being affluent, based on these misconceptions, users may have believed incorrectly that they “bought” a level of security not available to MDI users. Indeed, because of this misconception, as I noted above, prior to the widespread availability of CGM I had grave concerns about the risks that could accompany the use of insulin pumps without sufficient diligence in finger-poke testing.