

Artificial Pancreas Research: Insights for Application

Hope Warshaw, MMSc, RD, CDE, BC-ADM

The *CPT Corner* you received on October 26th provided an overview of the Artificial Pancreas System's (APS) evolution and it detailed Insulet's ongoing engagement with APS research teams around the world. This article, Part 2, continues coverage of this topic and turns to what can be learned and how CPTs can apply insights from this ongoing research.

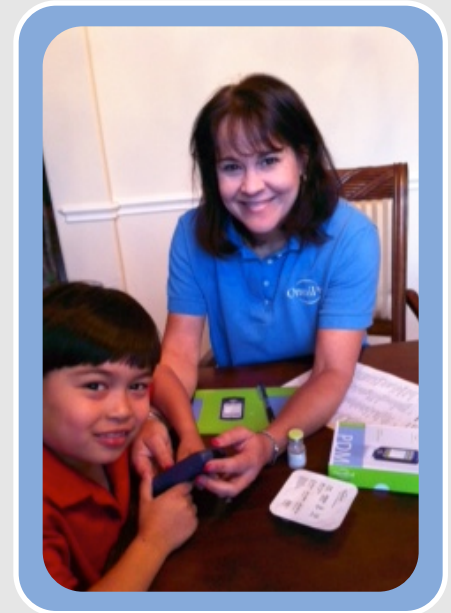
From Pumps to APS - Dramatic Differences

When you apply these insights, it's essential to understand the fundamental differences between current pumps and the APS. The major difference is that rapid-acting insulin is

not differentiated as basal and bolus. It's delivered in pulses (microboluses) with doses based on continuous glucose monitor (CGM) sensor data and other inputs. In a few of the APS systems being studied, the basal insulin dosing changes (modulates) continuously and constantly synthesizes past results to make smarter dosing decisions over time.^{1,3} Yes, very sophisticated!

APS Insights Can Impact Control Today

Read on to observe the findings that APS research has unveiled and think about how you may factor these insights into your work as a CPT.



Insights	APS Research Findings	Applying the Insights
Glucose control is complex.	Controlling glucose within desired target ranges requires individualization and continuous revision. ^{1, 2, 3}	<ul style="list-style-type: none"> - Portray managing diabetes as complex and dependent on many factors. - Remind pumpers that many reasons exist for unexpected highs and lows. - Encourage pumpers not to blame or judge themselves for every out-of-range glucose result.
Absorption of rapid-acting insulin varies.	A wide range of inter-person (between individuals) and intra-person (within the same person) differences in insulin absorption have been shown ³ . These can impact the glucose-lowering response and can contribute to significant glucose fluctuations. ³	<ul style="list-style-type: none"> - Describe potential variations in insulin absorption from pumper to pumper and within the same pumper. - Encourage an appreciation of this reality because absorption contributes to glucose excursions.
Faster-acting insulin is needed.	Control of post-meal glucose rise is a challenge due to the relatively slow absorption of rapid-acting insulin in relation to the rise of glucose from foods. ^{1, 2, 3}	<ul style="list-style-type: none"> - Raise awareness of the usual action curve of rapid-acting insulin in relation to the usual rise of glucose from foods. - Remind pumpers to continually rotate Pod sites to help diminish overuse of sites and promote proper insulin absorption. - Remind pumpers about the impact of various foods and combinations of foods on the total rise and rate-of-rise of glucose levels.

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<p>Glucose control during and after physical activity can be quite varied.</p>	<p>Managing glucose excursions and insulin needs during and after exercise can vary.^{3,4} This is due to the wide range of physical activities people partake in, their level of fitness, and the timing, intensity and duration of their activities.</p>	<ul style="list-style-type: none"> - Help pumpers gain an understanding of the impact of physical activity on their blood glucose by encouraging them to check glucose levels before, during and after activity. - Help pumpers explore the use of temp basal for physical activities.
<p>Postprandial glucose control can be difficult to predict.</p>	<p>The timing and amount of insulin to take in relation to food intake is difficult to accurately determine.²</p>	<ul style="list-style-type: none"> - Raise awareness that foods, both individually and when combined as meals or snacks, can have varied impacts on post-meal glucose levels. - Encourage accurate carbohydrate counting and bolus dosing to maximize glucose control. - Offer practical tips and strategies to improve carbohydrate counting and portion control. - Help pumpers explore the use of the extended bolus feature when applicable. - Encourage pumpers to create their personal history of glucose responses to foods and meals. Also remind pumpers to program their Carb Presets and utilize their food library.
<p>Hormonal responses can be multiple.</p>	<p>Glucagon is important in modulating glucose and has a role in preventing hypoglycemia.³ Hormonal changes occur during various phases of life, such as adolescence and menopause, or in women during menstrual cycles.⁴ Hormonal changes during sleep can increase night time hypoglycemia.¹</p>	<ul style="list-style-type: none"> - Describe insights about hormonal changes to help demystify the complexities of glucose control and insulin dosing. - Encourage pumpers to check their glucose and learn to gain insights into the impact of hormonal changes on their glucose control. - Help pumpers explore the use of different basal segments within a basal program and learn how to create and use different basal programs.

When you observe the insights garnered from APS research, it's clear why glucose management can be complex and challenging. It's also a reminder that today's smart insulin pumps offer pumpers features that can minimize glycemic excursions and maximize blood

glucose control. Continue to encourage pumpers to explore these features, and to continually learn about their individual glucose responses and fine-tune their glycemic control.

References:

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3. El-Khatib FH, Russell SJ, Nathan DM, Sutherlin RG, Damiano ER. "A Bihormonal Closed-Loop Artificial Pancreas for Type 1 Diabetes." *Science Translational Medicine*. (2010) 2(27):27

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