

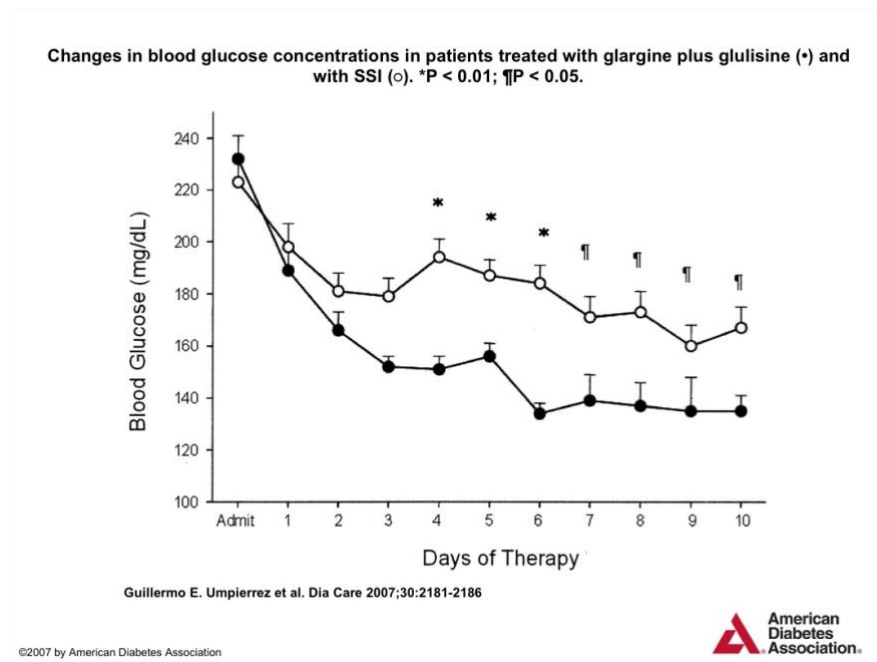
dear residents

Basal Bolus Insulin - The Physiologic Residency

Nov. 28, 2021

Dear Residents,

As you know, my residency training was in the late 80's. We learned to manage hyperglycemia in the inpatient setting with sliding scale insulin (SSI). As long as the serum glucose was below 180, there was nothing to be done. Then there were 2 units and 4 units and 6 units of regular insulin provided for various levels of serum glucose above 180. It never seemed enough and we generally chased the glucose all day long. The fear of hypoglycemia compounded by the fear that the patient wouldn't eat for one reason or another, permitted us to accept this 180 threshold - it served as a safety cushion. Fast forward to the 2000's – [evidence](#) began to emerge that hyperglycemia from any cause was associated with poorer inpatient outcomes, and while tight hyperglycemic control in the ICU was eventually [shown](#) to be a problem, the idea of providing physiologic insulin replacement with a basal dose of long-acting insulin combined with prandial doses of short-acting insulin caught on. Patients treated with basal-bolus regimens were [shown](#) to have better average glucose levels than those who were treated with SSI (without incurring hypoglycemia). We had clearly ignored the physiology of insulin secretion and glucose regulation for decades.



Many of the decisions we make in life (with or without algorithms) are driven by thresholds. We'll fill our gas tank when it's at the quarter mark or below, we'll wait 24 hours before sending an email reminder, we will dialyze if the potassium rises above 7. Some thresholds are set by consensus while others by personal judgment, which is not always rational. In 2017, [Richard Thaler](#), won the Nobel Prize for economics for the insight that people were "predictably irrational." Whatever rationality we have is "bounded" by the combination of information that we have available at hand and our mental capacities. Add to that our preference for the status quo, it should come as no surprise that it took a while for basal-bolus management of inpatient hyperglycemia to become the norm.

Residency training is full of thresholds – 80 hours per week, 10 admissions per call cycle, 1 day off in 7, 36 months of training. None were derived from any form of empiric inquiry and are largely based on consensus or tradition. The two trials that examined limiting work hours had mixed [results](#). We have all experienced fatigue and loss of functioning well before 80 hours or continued to feel energized and productive well beyond 80 hours. Occasionally fewer than 10 admissions can overwhelm us; at other times they are easily managed. Some of us feel competent and ready for independent practice well before 36 months of training while others may wish they had a month or two of extra rotations to fill gaps in their learning. My sense is that these thresholds were set for purposes of surety and safety. It feels a lot like a serum glucose of 180 to me – tolerable but not necessarily optimal.

Residency training has evolved through tradition and a few discreet events (like the death of [Libby Zion](#)) and from the increasing recognition of physician [stress](#) and burnout. The physiology of residency training (if there is such a thing!) remains unknown and hard to study empirically – what's best, what's ideal, what's too much, what's too little. I don't have the answers, I'm just asking questions. The basal dose of work should ensure that you have enough clinical exposure, enough accountability and enough challenge to meet your basal learning needs. The bolus dose of work should guard against stress and both physical and emotional exhaustion. We tolerate a lot in this residency program because it's just sub-threshold or just over threshold – our critical care rotations constantly push these limits – or the inefficiencies of certain environments cause limits to be reached with lower workloads. An experiment with lower team loads – the [Aliko initiative at Hopkins Bayview](#) showed that residents experienced greater learning, better relationships with their patients and superior mentorship from their attendings – the decrease in patient load was the "gift of time."

I think about these matters a lot – we are in an era of high throughput and work compression – continually threatening the learning environment. It's my job to protect your education and your wellbeing. It's my job to challenge the status quo. It's also my job to pick a few fights and advocate for what's best for you – even though knowing what's best for you is often elusive. I depend heavily on your plainspoken assessments of your experience. That's the compass that guides me.

Warm regards,

Dino Kazi