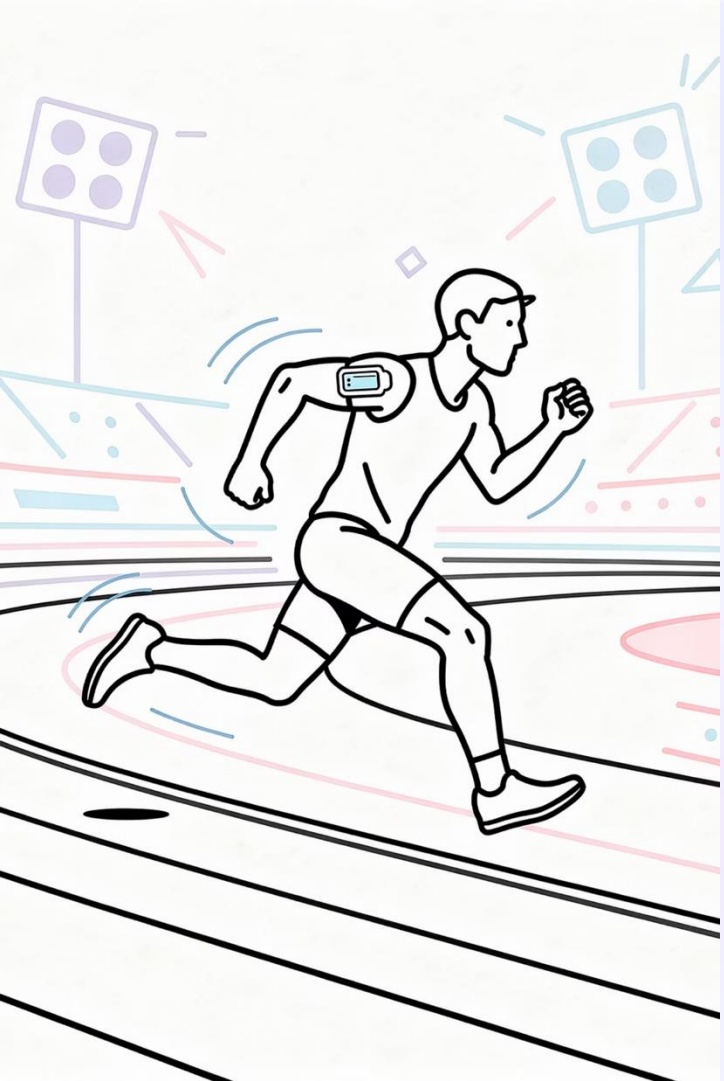


Managing Type 1 Diabetes in the Active and Athletic Patient

Marci Goolsby, MD
Primary Care Sports Medicine
Medical Director, Women's Sports Medicine Center
Hospital for Special Surgery — New York, NY
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Disclosures

I have no relationships to disclose.



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Opening Cases

Three Questions PCPs Hear in Clinic

"My patient wants to run a marathon. What do I tell them?"

"They're on an AID system (pump). Isn't it automatic now?"

"Their glucose was 280 before soccer practice. Should they delay starting it?"

Show of hands: *what would you say? We'll answer these at the end.*

Why This Matters

Exercise Is Medicine — But T1D Adds Complexity

The Opportunity

Regular physical activity improves insulin sensitivity, cardiovascular health, weight management, and psychological well-being in Type 1 diabetes. As a primary care provider, you're often the first and most trusted clinician to guide these conversations.

The Challenge

People with T1D must actively manage insulin, carbohydrate intake, and glucose targets around exercise. The physiology is nuanced, the technology is evolving, and the stakes are high.

You don't need to be an endocrinologist — know the principles, spot red flags, and refer when needed.

Lecture Outline

What We'll Cover Today

01

Exercise Physiology

How aerobic and resistance work move glucose.

02

Before Exercise

Targets, ketones, insulin dosing, a flowchart.

03

During & After Exercise

ExCarbs, treating lows, the 8–16 hour window.

04

Technology

Trend arrows, AID modes, CGM data in clinic.

05

Special Situations

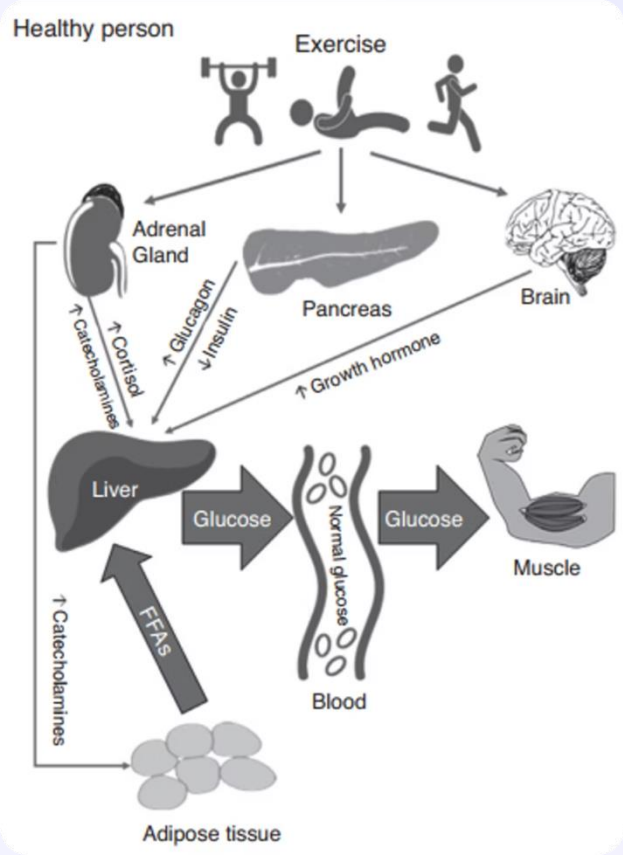
Competition day, youth, sports-med blind spots.

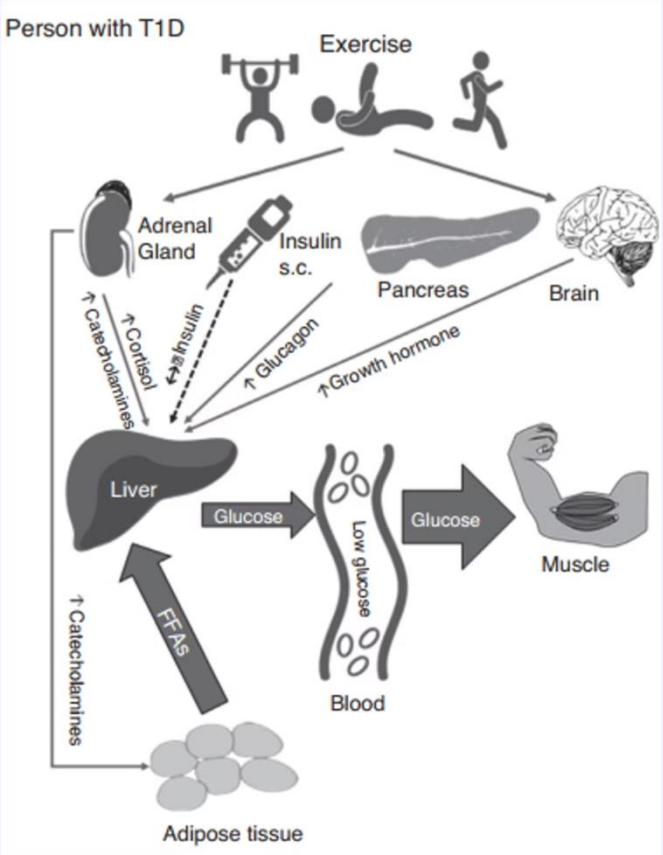
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Cases & Take-Home Pearls

Answering the questions PCPs hear most.

Exercise Glucose Response: Without Diabetes vs. T1D





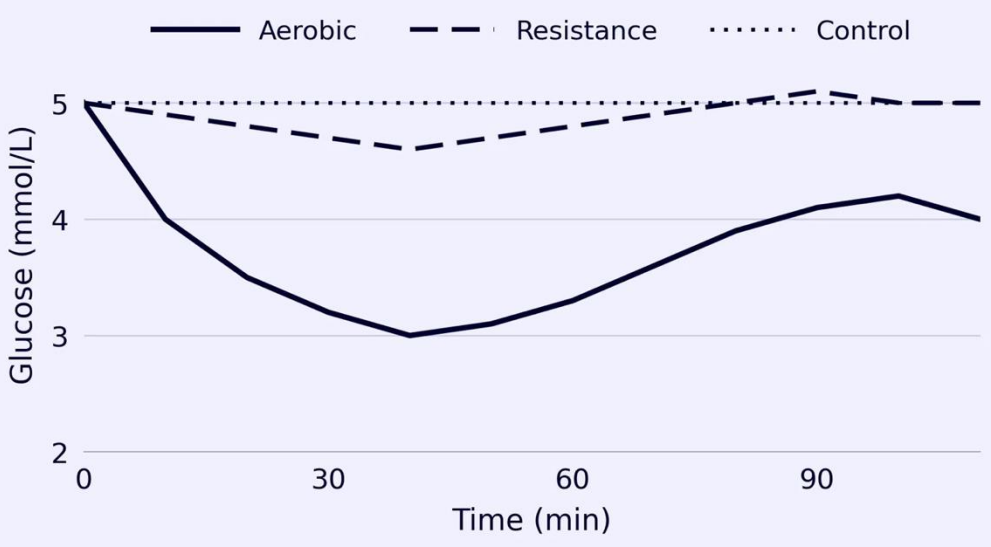
Aerobic vs. Resistance Exercise: What the Data Show

Aerobic:

- BG drops quickly, then rises slightly post-exercise
- Prevent with more carbohydrate before/during exercise and less insulin

Resistance exercise:

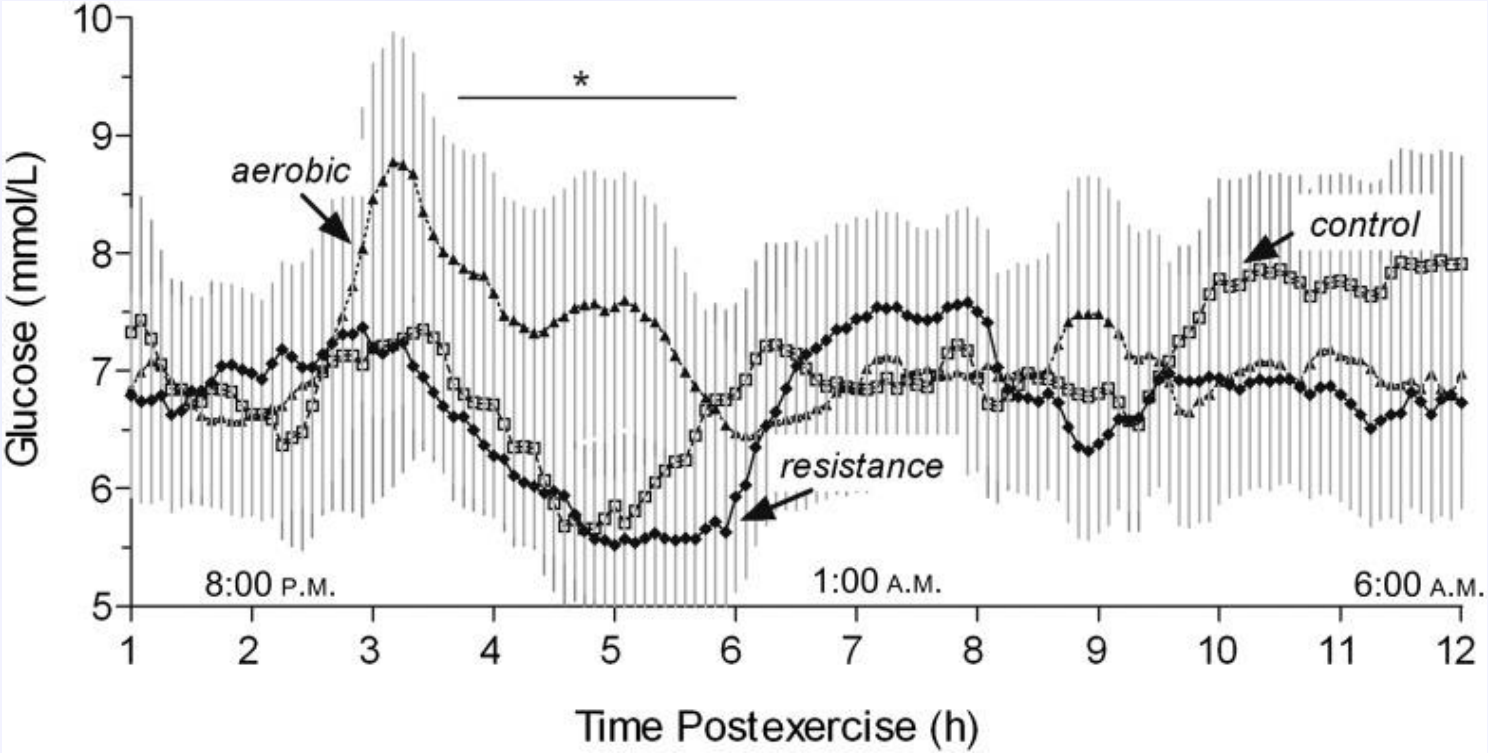
- Usually does not cause hypoglycemia, but responses vary
- Can cause a slight BG drop from increased uptake or a slight rise during/after exercise from catecholamines



Plasma glucose over 110 min of exercise and recovery: resistance, aerobic, and no-exercise control. Y-axis in mmol/L (multiply by 18 for mg/dL).

Reference: Yardley JE et al. Diabetes Care 2013;36:537–542

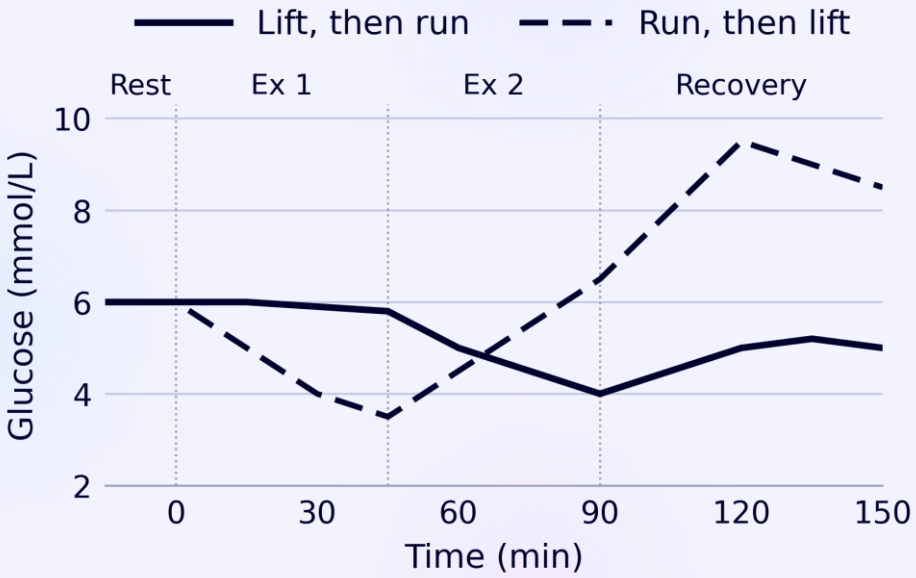
Aerobic vs Anaerobic Glucose Trends (continued)



Reference: Yardley et al. Diabetes Care. 2013; 36:537

Exercise Order in T1D: Lift Before or After Cardio?

Yardley JE et al. Diabetes Care 2012;35:669–75



Plasma glucose in mmol/L (×18 = mg/dL)

The study

12 active adults with T1D did a 45-min run and 45 min of weights in both orders

Run, then lift

Bigger glucose drop, more post-exercise lows

Lift, then run

Steadier glucose, milder lows

Take-home: lift first for athletes prone to exercise lows.

Exercise Physiology

High-Intensity Exercise: The Glucose Paradox

Why Glucose Rises

- **Adrenaline surge** → liver releases glucose
- **BG can jump 50–100 mg/dL** within minutes
- **Stays up 1–2 hours** after exercise
- **Triggers:** weights, sprints, team sports

Management Strategy

During: don't chase it; the rise is transient

After: expect a fall as glycogen refills; correct cautiously at 60–90 min

Mixed sessions: finish with 5–10 min of easy cardio

Warn patients ahead of time to prevent panic dosing.

Before Exercise

Pre-Exercise Glucose Targets

"Safe" is not a single cutoff: **hyperglycemia alone is NOT an absolute contraindication to exercise.**

Adults: Acceptable Range

90–250 mg/dL — generally safe to start. Use glucose trend and IOB to guide carbs and insulin reduction.

Pediatric / Adolescent

126–180 mg/dL — preferred pre-exercise target. Narrower range due to greater variability.

When to Postpone Exercise

Postpone for significant hyperglycemia with **ketosis or insulin deficiency** — not for hyperglycemia alone.

Check ketones if glucose >250 mg/dL. Postpone exercise if moderate-to-large urine ketones or blood beta-hydroxybutyrate >1.5 mmol/L. Ketosis — not hyperglycemia alone — is the main safety concern.

Sources: Riddell MC et al. Lancet Diabetes Endocrinol 2017;5:377–90 · ADA Standards of Care in Diabetes, Section 5 · ISPAD Clinical Practice Consensus Guidelines 2022 (exercise in children and adolescents)

Before Exercise

Insulin Adjustments Before Exercise: MDI vs. Pump

Multiple Daily Injections (MDI)

Cut the pre-exercise meal bolus when exercise starts within ~90 min of eating:

Intensity	30 min	60 min
Light (~25% VO2max)	↓25%	↓50%
Moderate (~50%)	↓50%	↓75%
Heavy (~75%)	↓75%	—

Basal: consider ~20% less on days of prolonged activity, and ~20% less bedtime basal after afternoon or evening exercise.

Insulin Pump

- **Temp basal ↓50–80%**, started 60–90 min before aerobic exercise (works better than at onset)
- Resume full basal right after exercise, before the recovery meal
- Must disconnect (contact or water sports)? Suspensions up to ~60 min are usually fine
- **Longer disconnects:** hybrid regimen (~50% of basal as single basal injection) improved time in range 64% vs. 40% in FIT Untethered

⚠ **Insulin on board at exercise onset is the strongest predictor of hypoglycemia.** PCP pearl: ask, “What do you usually do with your insulin before you work out?”

Bolus table: Rabasa-Lhoret R et al. Diabetes Care 2001;24:625–30 (as summarized in Riddell 2017). FIT Untethered: Aronson R et al. Lancet Diabetes Endocrinol 2020;8:511–23.

Before Exercise

Pre-Exercise Decision Flowchart

First: check glucose, trend arrow, and insulin on board. Falling arrow or recent bolus → act as if one range lower.

< 90 mg/dL	**Delay exercise.** Eat 10–20 g fast carbs; recheck and start once above 90 mg/dL.
90–125	**Eat ~10 g carbs before aerobic exercise.** Anaerobic or HIIT sessions can usually start.
126–180	**Go.** Ideal starting range for most sessions (and the target range for youth).
181–250	**Go.** Aerobic work will usually bring BG down; anaerobic work may push it higher.
> 250	**Check ketones first.** Blood BHB < 0.6: OK, monitor closely · 0.6–1.4: correct before exercising · ≥ 1.5: postpone.

Adapted from Riddell MC et al. Lancet Diabetes Endocrinol 2017;5:377–90 and ADA Standards of Care. Adult ranges; youth prefer 126–180 mg/dL.

Actionable Pearl: Print or share this algorithm with active T1D patients. It gives them a repeatable pre-workout decision structure.

During & After Exercise

ExCarbs: Carbs Are the Main Lever

Insulin can't be cut in real time, so **carbs are the main tool** to prevent lows during aerobic exercise.

Adults

~0.5 g/kg/hr

70 kg adult ≈ 35 g/hr

Youth

~1.0 g/kg/hr

About double the adult rate

Near a Meal Bolus

Need more

Within 3 h of a meal bolus

Weight	Adult	Youth	Adult example
40 kg	20 g/hr	40 g/hr	1 gel
60 kg	30 g/hr	60 g/hr	16 oz sports drink
70 kg	35 g/hr	70 g/hr	Banana + 2 chews
90 kg	45 g/hr	90 g/hr	Gel + 12 oz drink

During & After Exercise

Treating Exercise-Related Lows

Glucose <70 mg/dL During Exercise

- **Stop** the activity
- **15–20 g fast carbs**, recheck in 15 min
- **Resume** once >100 mg/dL and stable

Glucagon Access

- **Glucagon** at every practice and game
- **Nasal or auto-injector:** easiest to give
- **Coaches and ATs** trained to use it

Adrenaline can mask symptoms. Rely on CGM alerts.

After a Significant Low

- **Cut insulin 10–20%** for 24 h
- Review CGM trends

During & After Exercise

The Danger Zone: Post-Exercise Hypoglycemia

The riskiest lows come AFTER exercise, especially overnight.

Why It Happens

- **Muscles refill glycogen for 8–16 h** after prolonged or intense exercise
- **Prior lows blunt** the counter-regulatory response

Overnight Strategies

- **Bedtime glucose >130** after long sessions
- **Snack:** complex carbs + protein
- **Go easy** on overnight corrections
- **Raise CGM low alert** to ~80 mg/dL
- **Remote CGM sharing** overnight

Technology

CGM: The Athlete's Advantage

During activity, **trends matter more than single readings.**

Trend Arrows

140 + falling arrow needs carbs; flat 140 doesn't

Remote Monitoring

Coaches and parents can follow glucose live

Confidence

More exercise, fewer fingersticks

Exercise Alerts

Tighter low/high alerts around training

↓↓ **before exercise:** take 15–20 g carbs
↑↑ **before competition:** don't overcorrect; adrenaline often settles it

Technology

Activity Mode: Five Principles

Raises the target glucose (some systems also cut insulin) to **lower insulin on board.**

1. **Time it:** Turn it on 1–2 h before exercise, not at the start
2. **Carry carbs:** Treat if glucose falls below ~126 mg/dL
3. **Watch auto-corrections:** Carbs may trigger insulin (e.g., Control-IQ)
4. **Trim the meal bolus:** By ~25–33% if exercising within 2–3 h of eating
5. **Match the sport:** Use activity mode for aerobic exercise; weights and sprints may not need it.

Sources: Moser et al., Diabetologia 2025 (EASD/ISPAD position statement); Basset-Sagarminaga et al., Diabetes Obes Metab 2026; Adolfsson et al., J Diabetes Sci Technol 2024.

Technology

Activity Mode by System

Know which system your patient uses. Targets and safety behaviors differ.

System	Mode / target	What to know
Tandem Control-IQ	Exercise **140–160 mg/dL**	Auto-corrections still fire above 180 mg/dL, so carbs can trigger insulin; timer 30 min–8 h
Medtronic 780G	Temp Target **150 mg/dL**	Pauses auto-correction and meal detection; turns off automatically
Omnipod 5	Activity **150 mg/dL**	Also cuts calculated insulin ~50%; set for 1–24 h
CamAPS FX	Ease-off **⩾150 mg/dL**	Suspends insulin below 126 mg/dL; log carbs as “hypo treatment,” not a meal
Diabeloop DBLG1	Physical Activity **+70 mg/dL**	Set intensity and duration; ZEN mode raises target 10–40 mg/dL for 1–8 h

Sources: Basset-Sagarminaga et al., Diabetes Obes Metab 2026; Berget et al., Diabetes Obes Metab 2025; Turner et al., Diabetes Care 2025; manufacturer guidance. Features change with software updates.

Technology

Using CGM Data at Clinic Visits

What to Review

Pull the AGP report; focus on exercise days.

- Lows after workouts?
- Overnight lows after evening exercise?
- Starting glucose too low or too high?

Use CGM patterns, not A1C alone.

Targets for Athletes

>70% time in range (70–180)

<4% time below 70

<1% time below 54

≤36% variability (CV)

GMI = CGM-estimated A1C

Special Situations

Training Day vs. Competition Day

On game day, **adrenaline can raise glucose before play even starts.**

Training Day	Competition Day
Predictable glucose; **lows** are the main worry	May rise 50–100+ mg/dL. **Start at 150–180 mg/dL.**

Warm up

10–15 min easy warm-up blunts the spike

Correct cautiously

Use ⩽50% of the usual correction

Don’t chase it

Nerves drive overdosing; stick to the plan

Special Situations

Young Athletes: Different Targets

Narrower Target

126–180 mg/dL before exercise; adults watch closely

More ExCarbs

~1.0 g/kg/hr, double the adult rate

Team Communication

Coaches and teammates know the signs and supplies

Overnight Risk

Remote CGM after evening games; higher bedtime target



Special Situations

Sports-Medicine Issues PCPs Often Miss

Anti-Doping: TUE

Insulin is WADA-prohibited; **tested athletes need a TUE**

Insulin Omission

Skipping insulin for weight → **DKA risk.** Screen for Triad/RED-S if A1C high, weight loss or DE signs

Menstrual Cycle

Luteal phase: insulin needs often rise in luteal phase

SGLT2 Inhibitors

Euglycemic DKA risk with long exercise, low carbs or illness

High-risk sports (scuba, climbing, open water): low-glucose plan, buddy, CGM alerts

Special Situations

Some Personal Insights

1. The psychological side

Fear of lows can limit more than lows; running high “for safety” hurts performance; avoiding attention

2. How lows and highs feel

Lows: shaky legs, confusion. Highs: thirst, “heavy legs”

3. Staying in range

Log practice vs. game days; adjust and iterate

4. Nutrition

Anything goes; less-processed food is easier to manage

MANY factors affect glucose

The top five for athletes:

1. Exercise type & intensity
2. Insulin on board
3. Adrenaline & stress
4. Meal timing
5. Heat, altitude & sleep

Insights credit: Lauren Bongiorno, Risely Health (riselyhealth.com). “42 Factors That Affect Blood Glucose”: Adam Brown, diaTribe.

Cases & Take-Home Pearls

Back to Our Cases: What PCPs Hear in Clinic

"My patient wants to run a marathon."

Yes, with a plan: CGM, ExCarbs, and watch for lows 8–16 h later

"Isn't AID automatic now?"

No. Activity mode, timing, and carbs still matter

"280 before soccer. Skip it?"

Check ketones. Negative and feels well? Play and monitor

Summary

Key Takeaways at a Glance



These eight principles are the practical foundation for counseling active patients with Type 1 diabetes. Use them to give confident, evidence-based guidance at every visit.

Summary

Key Takeaways at a Glance

1. **Responses are individualized**
2. **Aerobic exercise lowers glucose**
3. **Anaerobic exercise may raise glucose**
4. **Ketones, not glucose alone, are the concern**
5. **Start at 90–250 mg/dL; youth 126–180**
6. **ExCarbs: 0.5 g/kg/hr; youth 1.0**
7. **Most lows: 8–16 h after exercise**
8. **AID helps but still needs a plan**

Eight principles for counseling active patients with T1D.

Questions?

goolsbym@hss.edu



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