JDRF PEAK
TID Performance in Exercise and Knowledge

DIABETES AND DEDICATION: SUCCEEDING WITH SPORTS & EXERCISE

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PEAK

- PEAK = Performance in Exercise and Knowledge. First evidence-based guidelines for exercise and T1D.
- Funded by Novo Nordisk
- PEAK developed by 21 international experts in medicine, physiology, diabetes research, nutrition, and coaching
- PEAK guidelines are *starting points* for nutritional and insulin dose adjustments to keep in targeted blood glucose ranges. They should be tailored to the individual, based on experience and healthcare team recommendations

The JDRF PEAK guidelines are not medical advice. Please consult with your healthcare provider before making any changes

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BE ON THE MOVE

Exercise is amazing medicine

Long-term concern	Exercise effect
Heart disease	Collateral circulation Reduces risk of atherosclerosis
Elevated blood lipids	Improves cholesterol levels
High blood pressure	Reduces diastolic blood pressure
Obesity	Calorie burning Increases metabolism Appetite suppression

ACSM/ADEA joint position statement. *Diabetes Care* 2010;33:e147–e167; ADA Standards of Medical Care in Diabetes. *Diabetes Care* Volume 39, Supplement 1, January 2016; *International Journal of Obesity* (online pub 6/4/13).

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BE ON THE MOVE

Exercise is amazing medicine

Short-term concern	Exercise effect
Stress	Tension release More restful sleep
Depression	Sense of control, pride
Pain	Endorphin production

ACSM/ADEA joint position statement. *Diabetes Care* 2010;33:e147–e167.

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BE ON THE MOVE

Exercise is amazing medicine

Glucose control	Exercise effect
Insulin resistance	Increases insulin sensitivity Increases glucose uptake by muscles
Post meal highs	Slows carbohydrate absorption Increases glucose utilization Accelerated insulin action

ACSM/ADEA joint position statement. *Diabetes Care* 2010;33:e147–e167; ADA Standards of Medical Care in Diabetes. *Diabetes Care* Volume 39, Supplement 1, January 2016; ADA/JDRF Type 1 Diabetes Sourcebook. Alexandria, VA, American Diabetes Association, 2013, p. 249–292.

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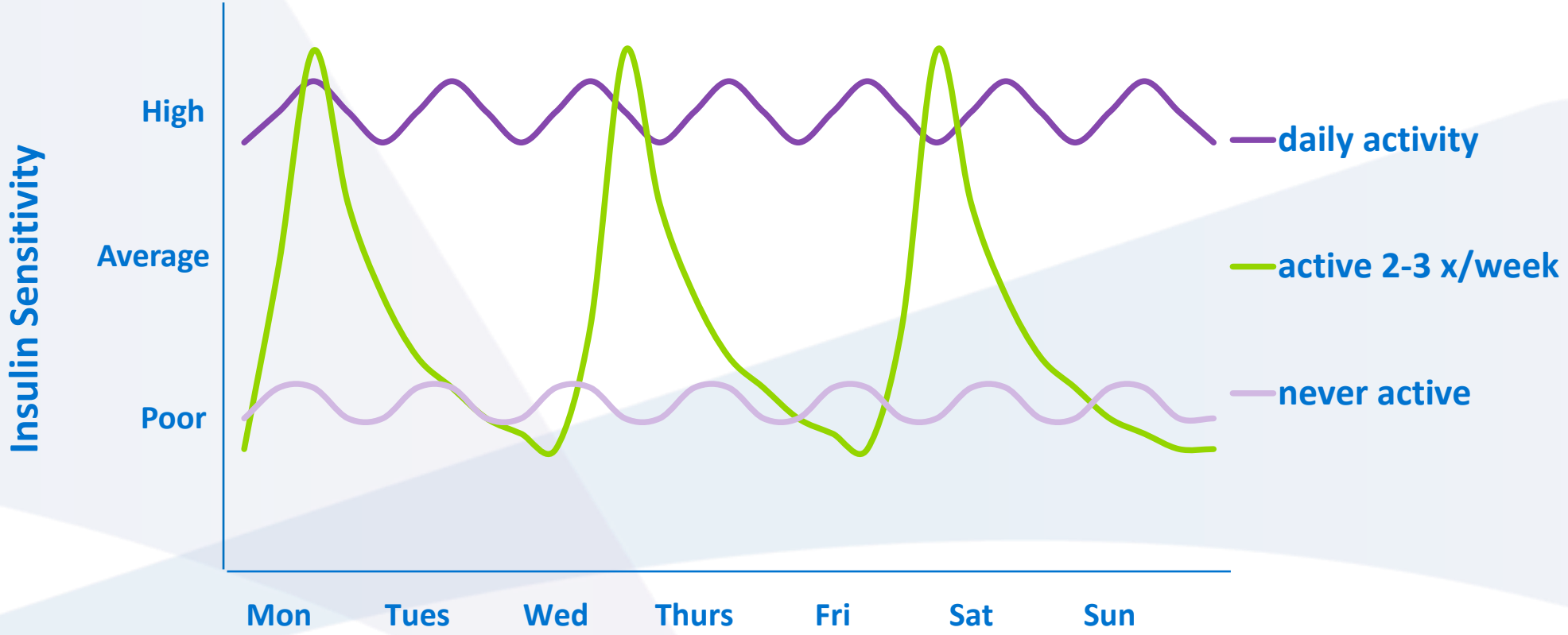
EXERCISE AND BLOOD GLUCOSE CONTROL

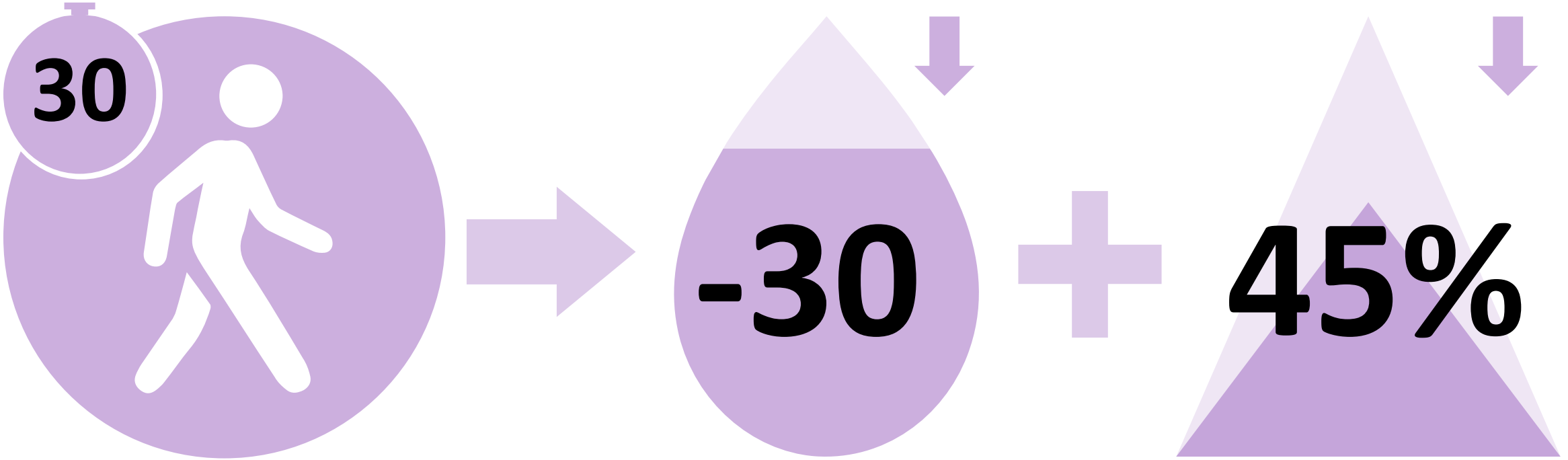
Consistent physical activity produces consistent insulin sensitivity



Scheiner, G: Schematic representation of insulin sensitivity

EXERCISE AND BLOOD GLUCOSE CONTROL

Post-meal benefits of physical activity



30 minutes of casual stop & go walking after meals

Average 30 mg/dL post-meal blood glucose reduction

Post-meal peak reduced 45%

Manohar C, *et al., Diabetes Care*. 2012 Dec;35(12):2493-9.

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EXERCISE AND BLOOD GLUCOSE CONTROL

Glucose levels during sport impact performance in many ways

- Strength
- Stamina
- Speed/agility
- Flexibility
- Safety
- Mental sharpness

Kelly D and Riddell M. Blood Glucose Levels and Performance in a Sports Camp for Adolescents with Type 1 Diabetes Mellitus: A Field Study. *International Journal of Pediatrics* 2010; Colberg, Sheri: *The Diabetic Athlete*, Human Kinetics, Champaign, IL, 2001; Walsh J *et al:* *Using Insulin*, Torrey Pines Press, San Diego, 2003.

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CASE #1 – BLOOD GLUCOSE CONTROL BEFORE EXERCISE

Types of exercise

Weightlifting, Tag
Sprinting, Diving, Swimming, Gymnastics,
Wrestling, Dodge ball, Volleyball, Ice hockey, Track cycling

Basketball, Football, Tennis, Lacrosse
Skating
Skiing (slalom & downhill), Field hockey
Rowing (middle distance)
Running (middle distance)

In-line skating
Cross country skiing
Brisk Walking
Jogging
Cycling

TIPS FOR EXERCISING SAFELY

Checklist for safe exercise practices

Item	**Individual with Type 1 diabetes**	Individual **without** Type 1 diabetes
Carbohydrate supplements (drinks and snacks)	✓	✓
Mobile phone (if exercising alone)	✓	✓
Water or electrolyte (calorie free) sports drinks to maintain hydration	✓	✓
Appropriate footwear and clothing for the specific exercise	✓	✓
Suitable hypoglycemia treatment	✓	✗
Medical card and/or bracelet/necklace	✓	✗
Glucose monitoring system	✓	✗

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Factors to consider when exercising

1	**Type of exercise**
2	**Duration and intensity of exercise**
3	**Timing of exercise in relation to time of meals**
4	**Insulin on board**
5	**Starting blood glucose**

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DON'T FLOOD THE ENGINE

Factors that affect blood glucose during exercise

- Active insulin
- Infusion site
- Food consumed
- Time of day
- Emotional state
- Temperature and humidity
- Amount of prior activity
- Size and number of muscles involved
- Duration
- Intensity
- Familiarity with activity (training effect)

There are A LOT of variables!!!

Romijn *et al., Am J Physiol* 1993; Van Loon *et al., J Physiol* 2001; San Millan, I and Brooks, GA. 2015.

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BLOOD GLUCOSE CONTROL DURING EXERCISE

Three ways to manage drop in blood glucose

1	**Take Carbs**
2	**Reduce Insulin**
3	**Adapt Exercise Regime**

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BLOOD GLUCOSE CONTROL IMMEDIATELY AFTER EXERCISE

Two options:

1	**Exercise-cool down period**
2	**Bolus Insulin-50% of normal correction to start**

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Fluid Management is Essential

- Important for athletes with diabetes
  - Always carry a bottle of water
  - Increase fluid intake if BG levels are high to help lower BG
- Useful to have some idea of sweat loss to maintain sodium/electrolyte levels
- Aim for ~10% carbohydrate solution

American College of Sports Medicine, Sawka MN, Burke LM, Eichner ER et al. American College of Sports Medicine position stand. Exercise and fluid replacement. *Med Sci Sports Exerc*. 2007;39(2):377-390.

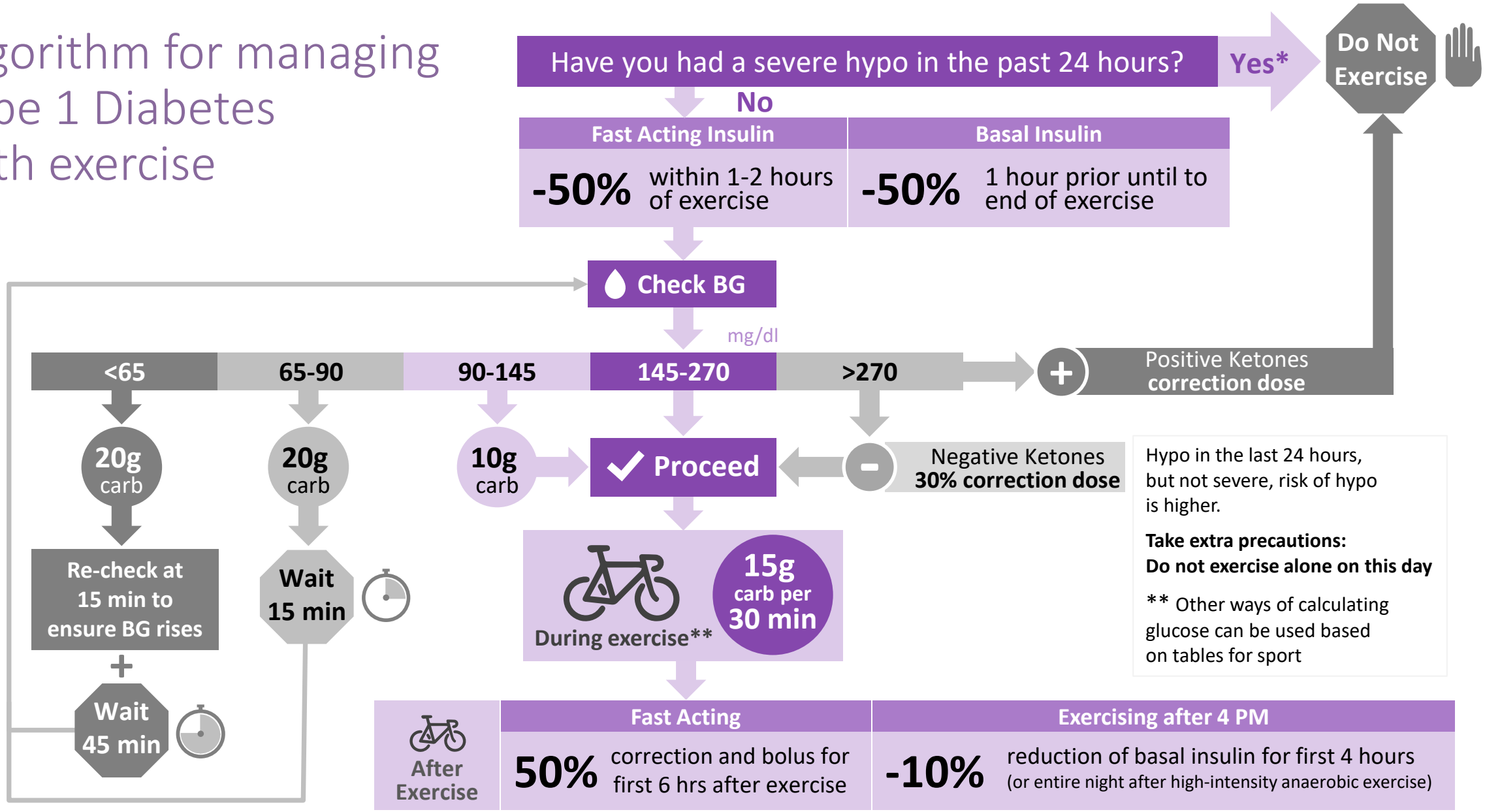
Milk as a Recovery Fluid

- Increased body of evidence of benefits of milk consumption post exercise for muscle protein synthesis, glycogen repletion and hydration

- One early study in type one diabetes demonstrated that whole milk post exercise was more effective than carbohydrate drinks at maintaining post exercise blood glucose and preventing hypoglycemia

Hernandez JM, *et al. Med Sci Sports Exerc* 2000;32(5):904-10.

Algorithm for managing Type 1 Diabetes with exercise



BG=blood glucose; hypo=hypoglycemia; Carb=carbohydrate

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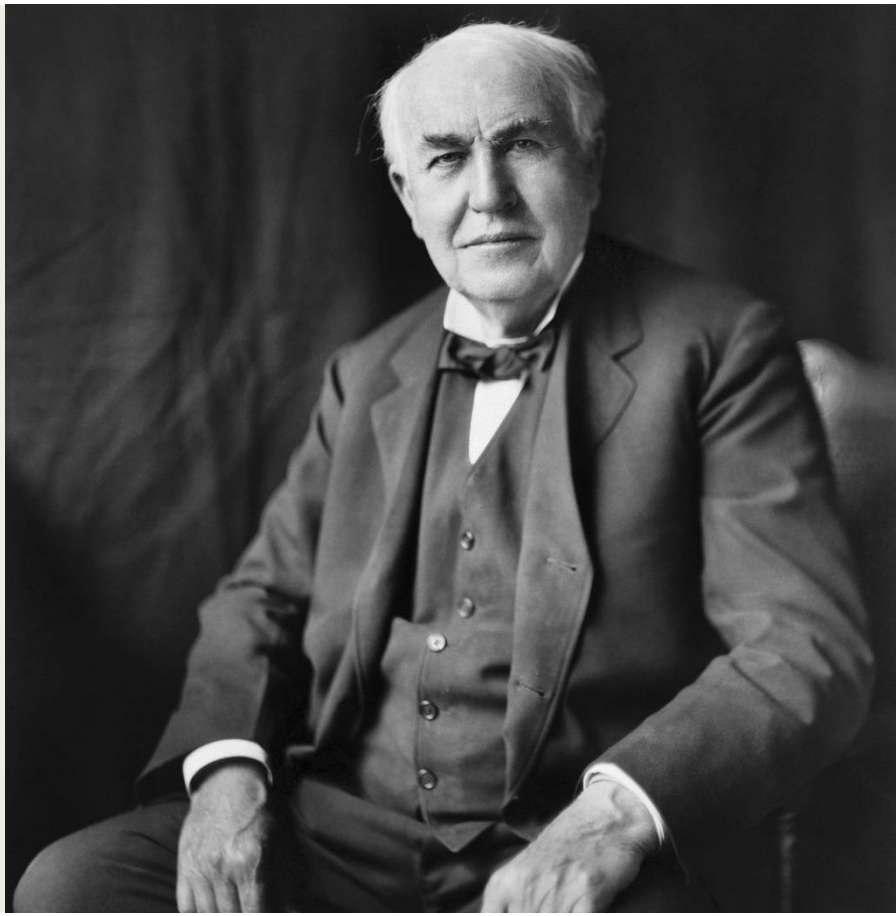
“I have not failed. I’ve just found 10,000 ways that won’t work”

Thomas Edison (1847-1931)



Get your motor runnin'…

- Physical activity **IS** important
- Exercise affects glucose control, glucose control affects exercise
- Consider the big blood glucose picture
- Strategize to avoid lows
- Strategize to avoid highs