

# Diabetes and Exercise

*Practical Tips for Prescribing and Monitoring*

**Sheri R. Colberg, Ph.D.**



Professor Emerita  
*Old Dominion University*  
*Norfolk, Virginia*

# Presenter disclosure

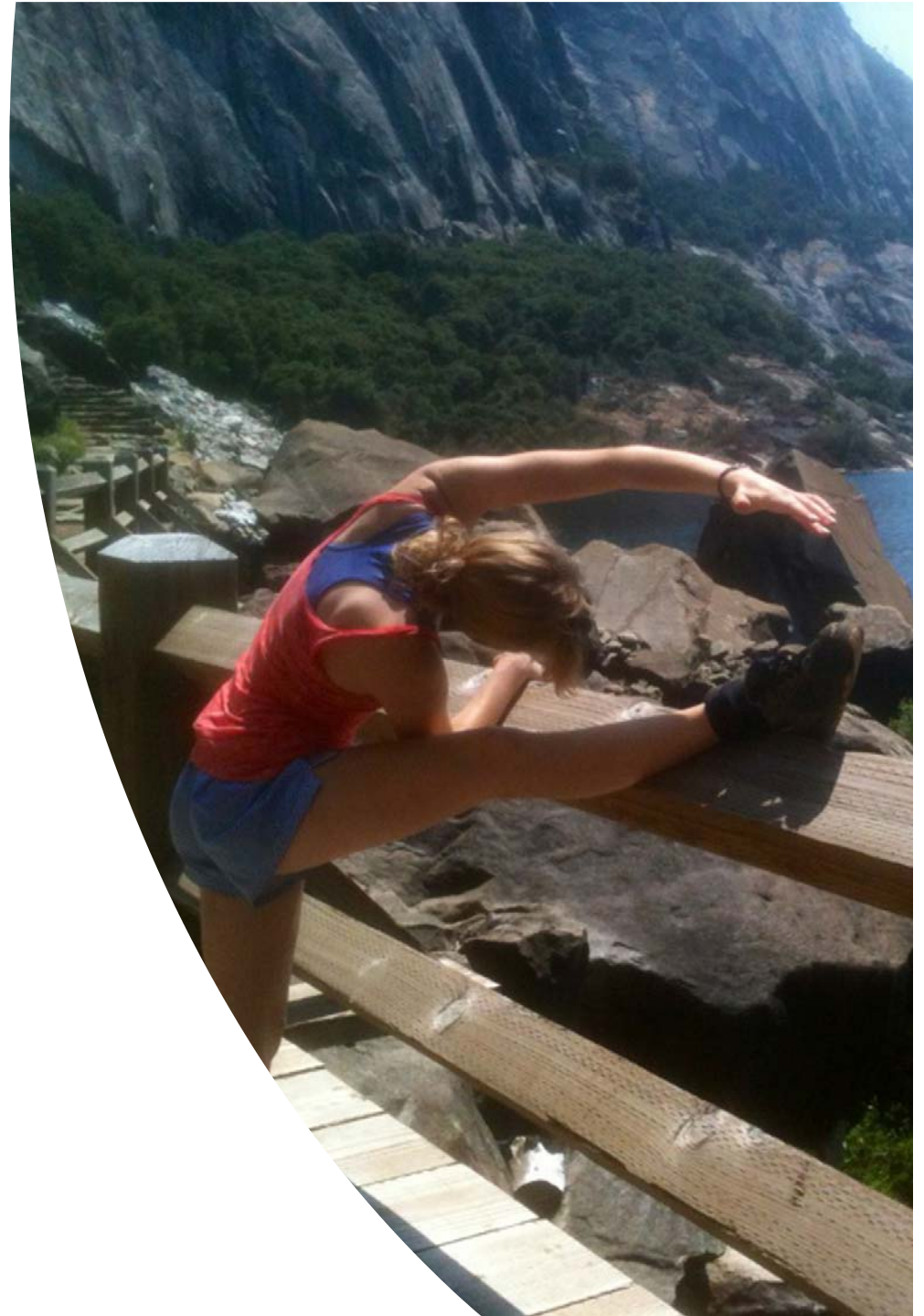
In compliance with the accrediting board policies, the American Diabetes Association requires the following disclosure to the participants:

Sheri R. Colberg, Ph.D.

Has no conflicts to disclose

---

# Exercise and Physical Activity Basics



# Managing health with exercise



- Regular physical activity is underutilized to manage health
- Optimize blood glucose, lipid, and blood pressure to prevent or delay health problems and complications
- Greatly improve metabolic health by taking small steps away from sedentary behavior toward greater physical activity

# Many factors affect exercise responses

## Exercise factors:

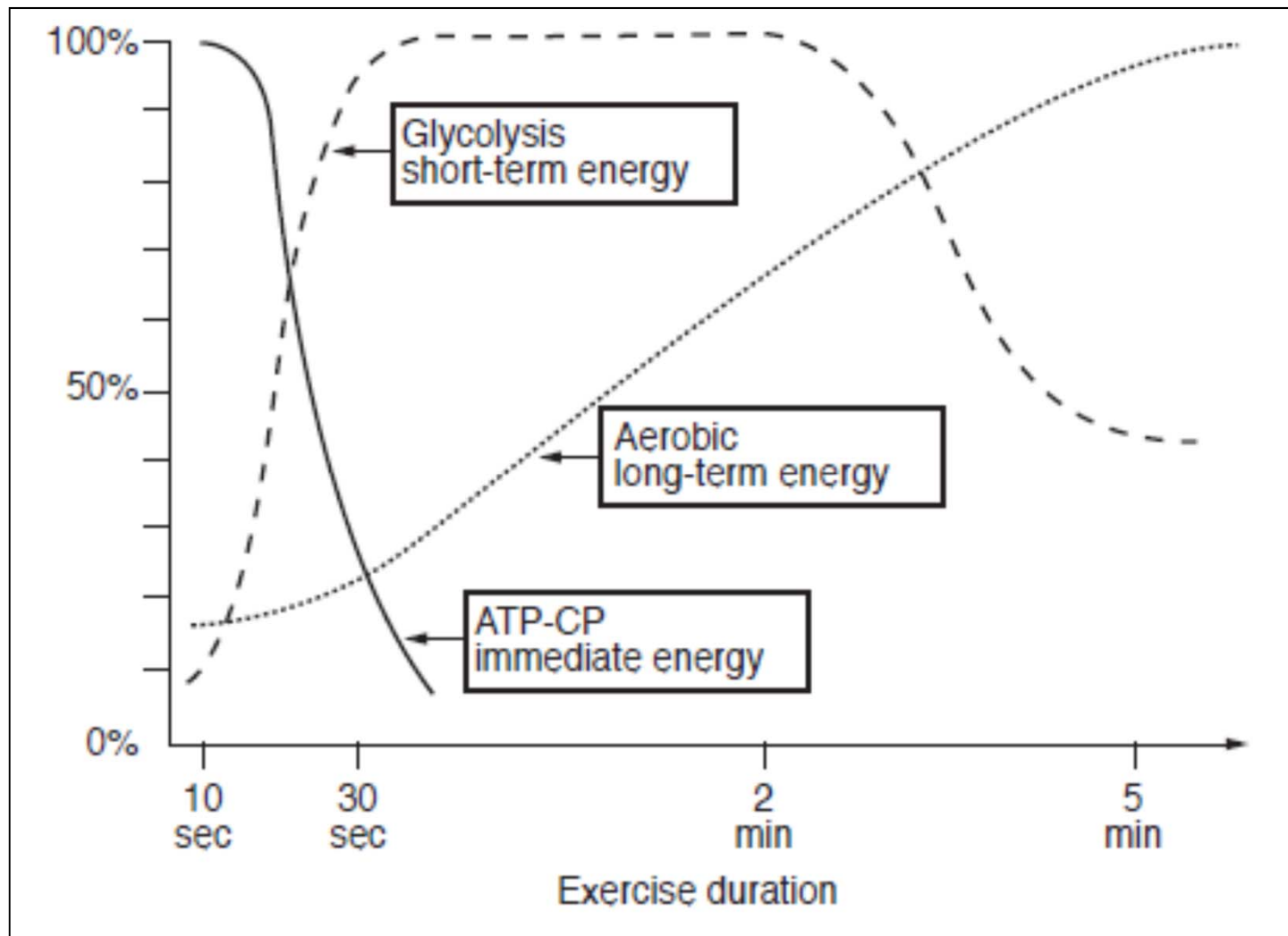
- Type, intensity, duration, timing, training state

## Environment:

- Heat, cold, humidity, altitude, air pollution



# Exercise energy systems



# Exercise can raise blood glucose

- Hormones increase production of glucose by the liver and reduce glucose uptake:
  - Glucagon
  - Epinephrine (adrenaline)
  - Norepinephrine
  - Growth hormone
  - Cortisol
- Exaggerated release during high-intensity activities in everyone; can cause lasting blood glucose rise in diabetes



# Glucose uptake during rest and exercise

- Blood glucose uptake into muscles occurs 2 ways:

(1) Insulin

- Rest
- Exercise

(2) Contractions

- Exercise



- Separate, but *additive* mechanisms during physical activity



# Physical activity improves insulin sensitivity

## **Aerobic** exercise:

- A single bout increases insulin sensitivity for 2–72 hours
- Greater glucose storage in muscle (as glycogen) post-exercise
- Enhanced fat metabolism



## **Resistance** training:

- Longer effect by increasing muscle mass (or slowing or preventing loss with aging)



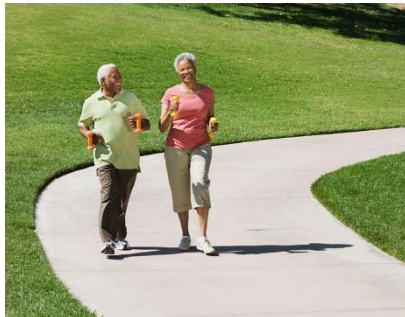
---

# Pre-Exercise Evaluation and Assessment



# Is a checkup needed before starting exercise?

- Depends on a person's age, health, and current activity
- Can usually start easy activities and walking without one
- May need checkup—or at least medical clearance—prior to starting harder exercise
  - Particularly if sedentary and plan to do vigorous exercise



# Who needs an exercise stress test?

- Medical consultation, diagnostic exercise testing for CAD useful when clinically indicated
- Not universally recommended to enhance exercise safety



# Exercise stress test for higher risk adults

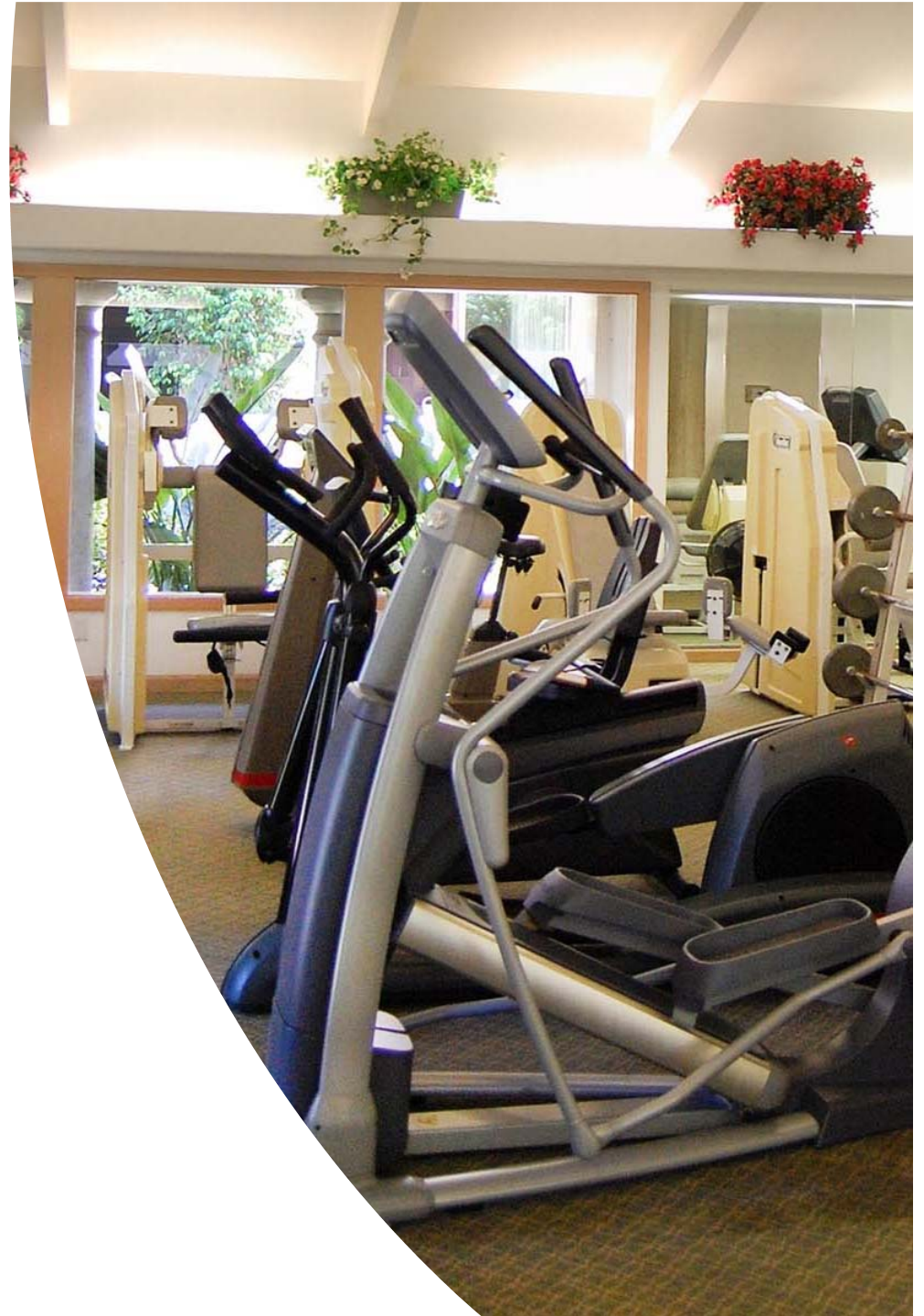
May be recommended prior to training for higher risk adults:

- Smoker
- High blood pressure
- High blood cholesterol
- Known macrovascular disease
- Microvascular disease (eyes, kidney)
- Over 40 years old with diabetes
- Over 30 years with diabetes 10+ years



---

# Prescribing Exercise for People with Diabetes



# Do exercise and physical activity differ?

## **Physical activity:**

- Includes all movement that increases energy use

## **Exercise:**

- Planned, structured types of physical activity



# Exercise program basics (FITT-VP)

**Frequency:** how often

**Intensity:** how hard

**Time:** how long (duration)

**Type:** mode of activity

**Volume:**  $F \times I \times T$  (expenditure)

**Progression:** moving forward





# Which activity is best for diabetes?



Aerobic/Cardio



Resistance



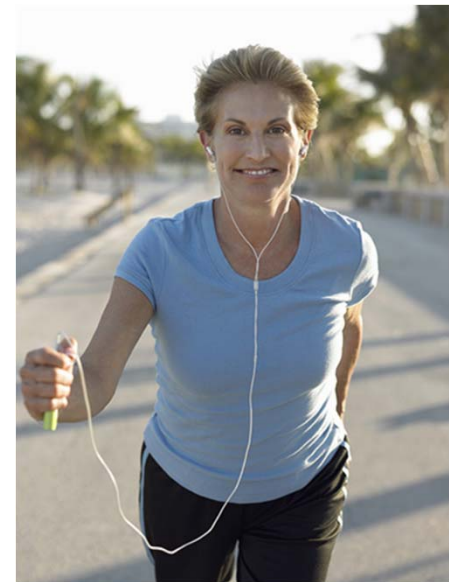
Flexibility



Balance

# Aerobic/cardio training

- Aim for 150 (to 300) minutes/week moderate, or 75 (to 150) minutes/week vigorous
- At least every other day
- Walking at any speed (good socks, shoes)
- Machines, stationary or upper body cycling, aquatic or chair exercise, rowing, dancing
- Bouts of <10 min for very deconditioned
- Interval training can be effective in adults



## Alternate aerobic activities



- Consider dancing, alternate fun activities
- However, high-intensity intervals, CrossFit, Burpees, etc. are not a good place to start people for most
- Medical clearance if sedentary or have cardiovascular risk
- Establish foundational fitness first
- Introduce slowly (1 day per week)



# How quickly should people progress?

- Depends on:
  - Age
  - Prior fitness/activity level
  - Fitness/health goals
  - Physical limitations/health concerns



- For most individuals, prudent to err on the side of caution: start slowly, progress slowly



# Why is resistance training critical for us all?

- Normal loss of muscle mass with aging
- Accelerated loss of muscle with:
  - Physical inactivity
  - Disease (including diabetes)
  - Rapid weight loss/dieting
- Carbohydrate storage tank critical
  - Both total capacity and depletion
  - Impacts insulin sensitivity



## Resistance training recs

- At least 2 days per week, preferably 3 (nonconsecutive)
- 15 reps moderate or 10 reps intense
- 2 to 3 sets per exercise
- 8 to 10 exercises for large muscle groups and “core”
- Machines, bands, free weights, household items, body weight as resistance
- Increase resistance when target repetitions or sets met, then number of sets, and lastly training frequency

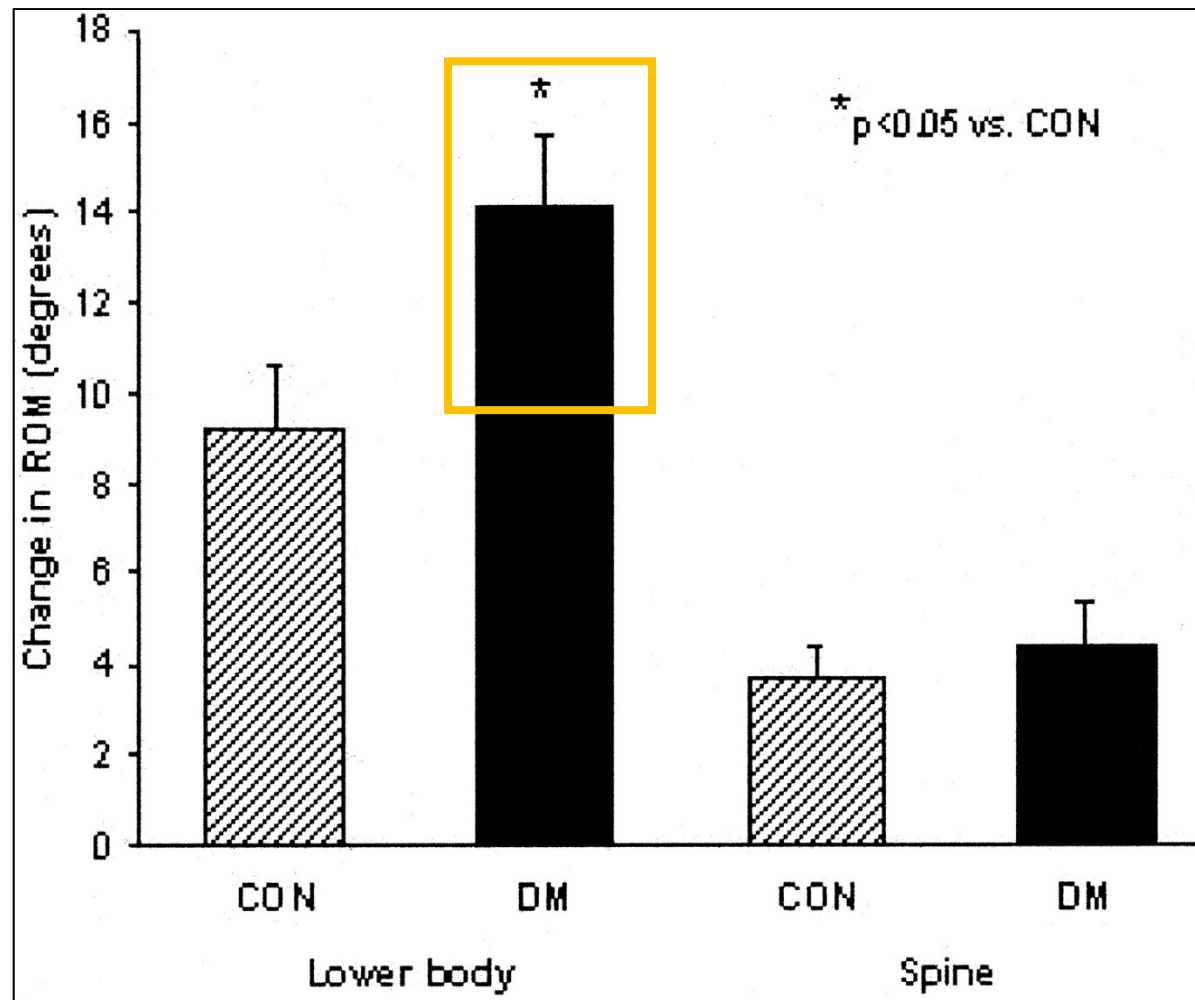


# Flexibility training

- Stretches best done at least 2–3 days per week or after any exercise session
- Warm up muscles first; include all major muscle groups
- Static stretches 10–30 seconds, or do dynamic stretching (with movement)
- Critical with aging and diabetes (glycation of joint structures)



# Flexibility training improves joint movement



Herriott M, Colberg SR, et al. *Diabetes Care*, 27(12): 2988-9, 2004



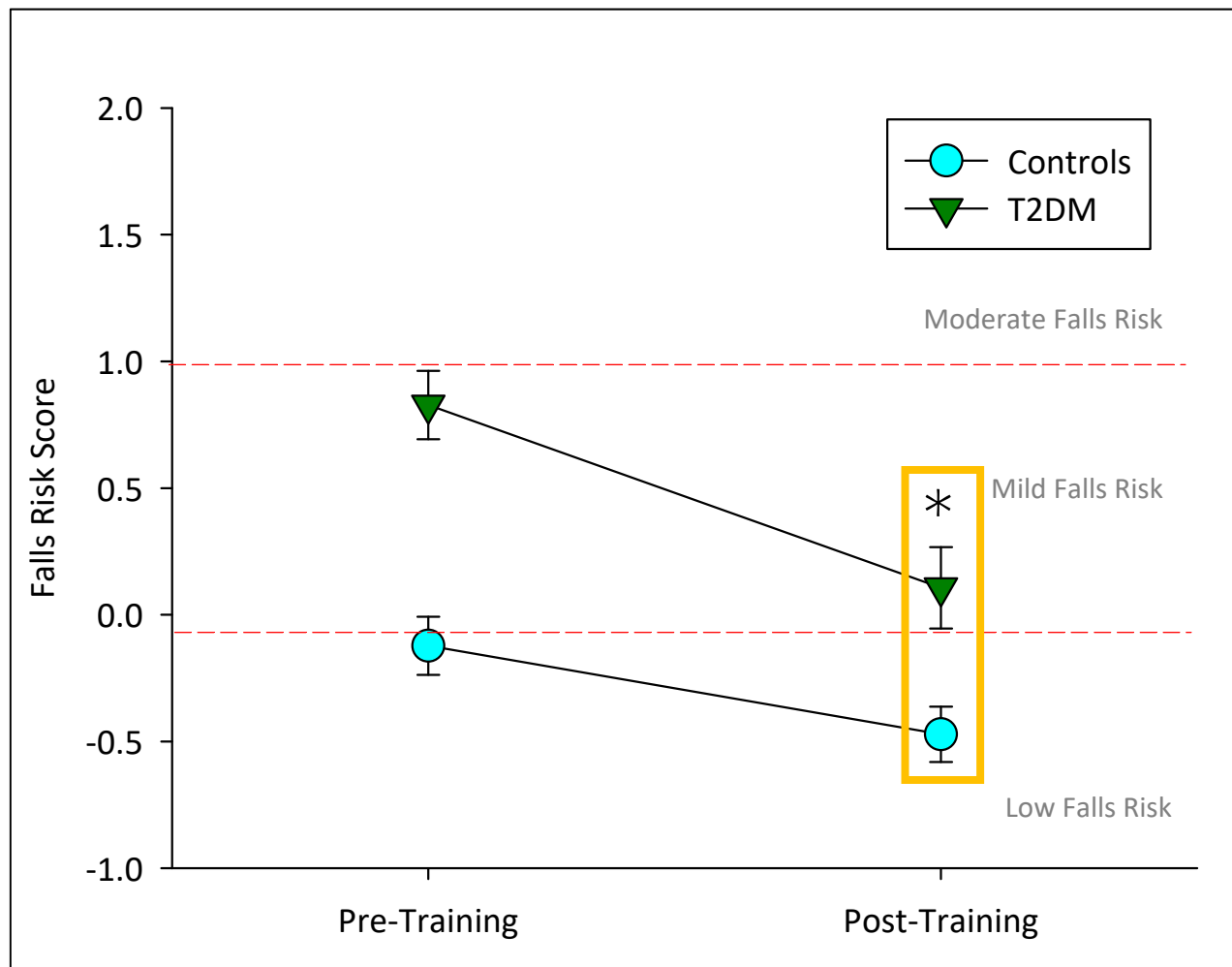
# Neuromotor/balance training

## “Functional fitness”

- Balance
- Agility
- Coordination
- Gait
- Proprioception



# Balance training reduces falls risk



Morrison S, Colberg SR, et al. *Diabetes Care*, 33(4):748-50, 2010

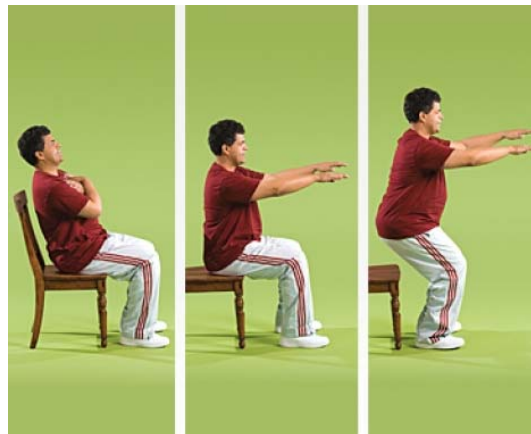
# Neuromotor/balance training

- Recommended for everyone over 40 years
- At least 2–3 days per week, but daily better
- Older adults:  $\geq 60$  minutes per week
- Lower-body/core strength exercises for balance
- Exercises using balance equipment, Balance exercises, equipment, uneven surfaces, pillow stand, tai chi, qigong, yoga, standing on one leg



# Simple balance exercises

- One-leg stand
- Side leg raises
- Toe and heel raises
- Toe towel grab
- Cushion stand
- Changed position stand
- Sit-to-stand
- Heel-to-toe walk
- Backward walk



## Combined/other training

- Combined training (aerobic/resistance) for optimal health and blood glucose management
- Done on the same or different days during week
- Activities like yoga and tai chi work on balance, flexibility, and strength at same time
- Enjoyable activities increase motivation



# More daily physical movement, or SPA time

- More spontaneous physical activity (SPA), or daily movement
- Adding in SPA during the day easier for many
- Fitness gains less, but still bestows health benefits
- Metabolic benefits from breaking up sedentary time

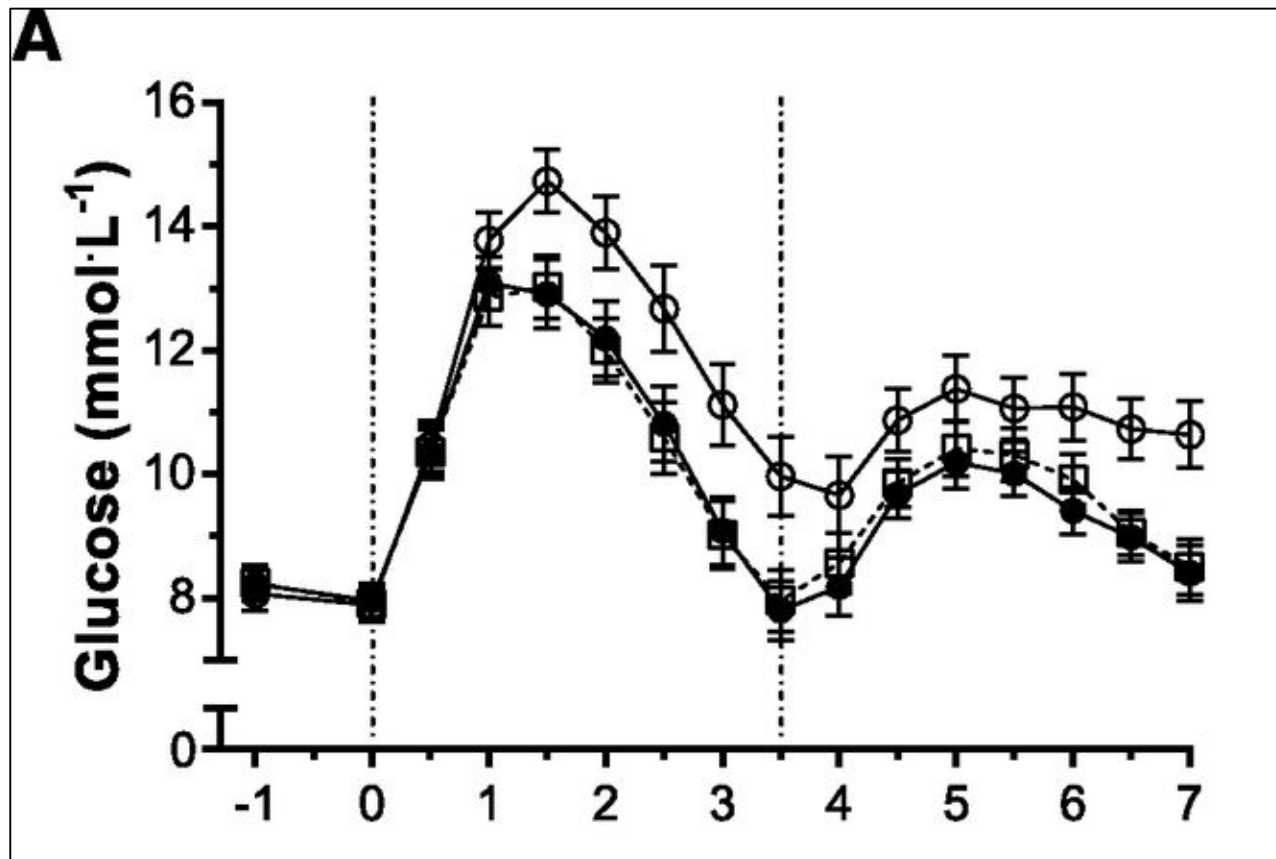


# Break up sedentary time frequently

- Gain metabolic and glycemic benefits from simply breaking up sitting time frequently
- Interrupt prolonged sitting with light to moderate activity
  - Walking or resistance exercises every 20 or 30 minutes



## Breaking up sedentary time (30 minutes)



3-minute  
walks or  
resistance  
exercise  
every 30  
minutes in  
adults with  
type 2  
diabetes



# Sustaining and Monitoring Participation

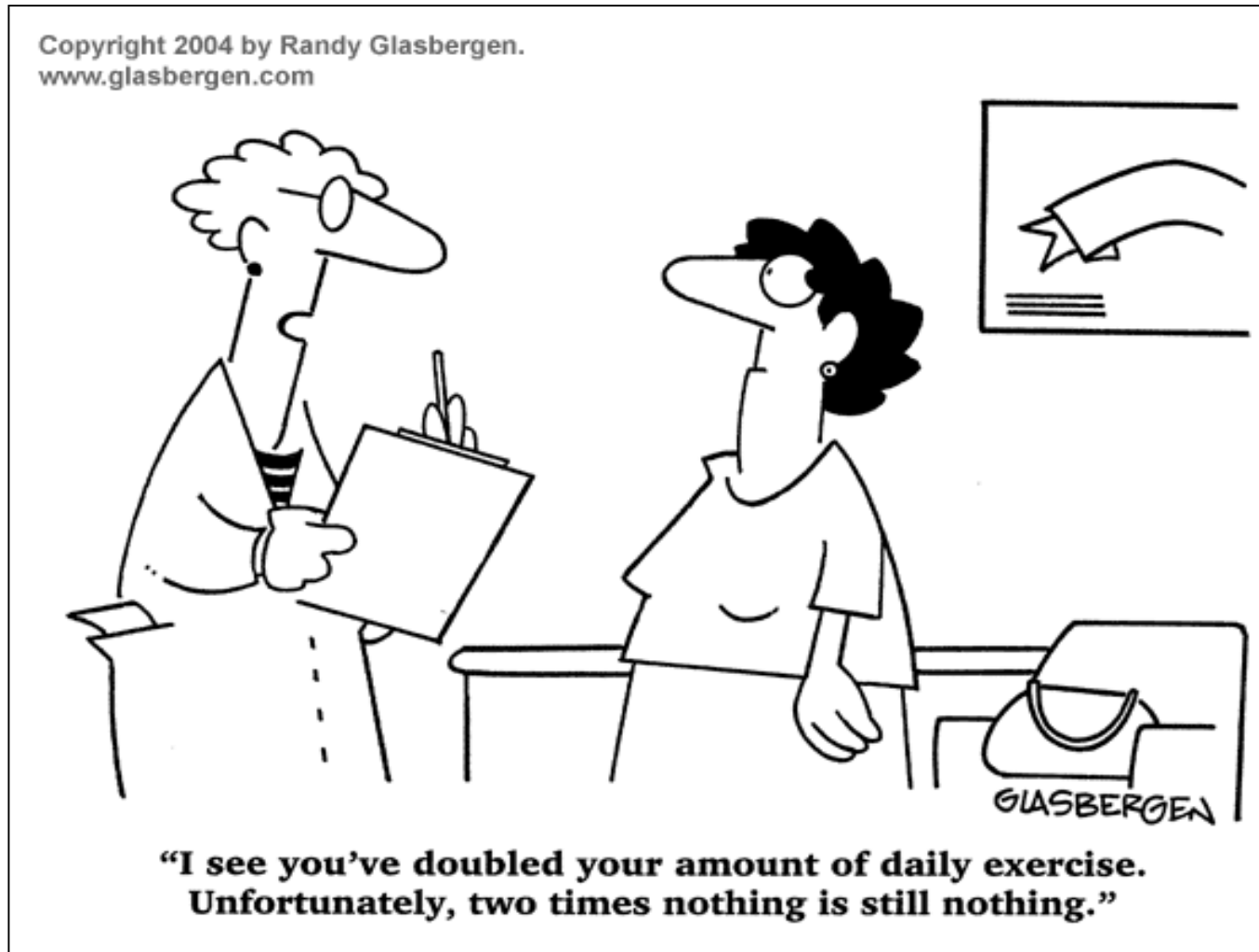


# What should everyone be doing?

- Get moving with aerobic activities
  - Work on getting and staying strong
  - Flex joints daily to stay limber
  - Practice staying on their feet
- 
- Move more all day long
  - Break up sitting time with activity
- 
- Get some physical activity every day



Usually every little bit of activity counts



# Common barriers to being active

- Lack of time (perceived or real)
- Lack of motivation/inertia
- Cost, transportation to, and accessibility of exercise areas
- Unsafe neighborhood; lack of sidewalks
- Activity not culturally appropriate
- Fear of falling among elderly (65+)
- Physical ailments/other constraints
- Fear of hypoglycemia

## Addressing barriers to being active

*“I don’t have time to exercise 30 min a day”*

- Break up exercise time throughout the day
- Start with 10 minutes daily, work up to more

*“I’m too tired after work to exercise”*

- Do something active before work or during the day instead

*“I don’t feel safe in my neighborhood”*

- Form a walking group
- Do classes on video or at a gym
- Be active near work or school

# Addressing barriers to being active

*“I can’t afford a fitness center or equipment”*

- Choose an activity that doesn’t require equipment
- Use cans of food or water bottles for weights
- Buy some inexpensive resistance bands
- Walk inside (at a mall, at work, at school, etc.)

*“I don’t have access to childcare”*

- Walk or bike with the kids
- Find a recreation center that offers childcare
- Get a group to take turns watching the kids



# What causes people to stop exercising?

- Perceived lack of time
- Start out at too high intensity
- Demotivation
- Exercise-related injuries



# How can injuries be prevented?

- Greater incidence of overuse injuries in overweight/obese and diabetes
  - Body weight/osteoarthritis issues
  - Glucose “sticks” to collagen, joint surfaces
  - Use of statins, some diabetes medications
- 
- Proper warm-up and cool-down
  - Appropriate starting intensity
  - Slower progression
  - Adequate rest
  - Cross-training/variety





# Facilitators of physical activity

- *Social Support:*
  - Activity buddy, family members, co-workers, etc.
- *Community Resources:*
  - Accessible fitness center, local pool, community center, etc.
- *Reminders and Cues:*
  - Notes, entry on calendar, reminder alarm
- *Rewards:*
  - Incentives to maintain motivation (preferably non-caloric ones)

## Setting SMART goals (for motivation)

S — Specific

M — Measurable

A — Attainable

R — Realistic

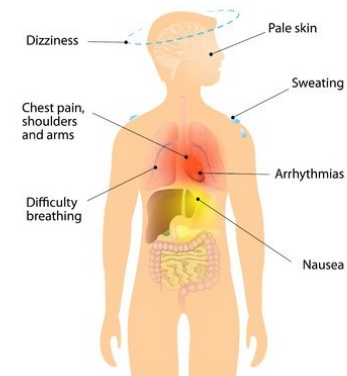
T — Time-bound

## Other exercise considerations/recs

- Anyone unable or unwilling to meet the exercise targets can benefit from doing less than recommended
- Health benefits from reducing total sedentary time
- Intersperse frequent, short bouts of standing and physical activity between sedentary activities
- Gradual progression of exercise intensity and volume may reduce any risks of exercise

- Screen for signs and symptoms of CAD

### HEART DISEASE SYMPTOMS



# Is activity possible with complications?

- Yes, but take appropriate precautions
- Common health co-morbidities:
  - Heart, peripheral artery disease
  - Hypertension
  - Elevated blood fats
  - Arthritis/joint limitations
  - Peripheral neuropathy (loss of sensation in feet)



# Case Study and Conclusions



## Case study: obese, hypertension, diabetes

- Female, 48 years old, type 2 diabetes for 7 years
- Currently physically inactive, but motivated to start
- Checks blood glucose at least once a day; fasting BG 158 mg/dL, A1C 7.2%
- 64 in, 190 lb, BMI 33 kg/m<sup>2</sup>, resting HR 85 bpm, BP of 138/86 mm Hg (on medications)
  
- Meds: metformin and antihypertensive agent
  
- Goals: lose weight, lower blood pressure with exercise

## Case study: questions to consider

- 1. What recommendations would you give to this individual for increasing her activity level?**
- 2. What precautions would you suggest?**
- 3. What strategies might you suggest to help motivate and support her efforts to establish regular physical activity as a lifelong habit?**

## Case study: questions to answer

### **1. What recommendations would you give to this individual for increasing her activity level?**

- *Activity:*

- Lifestyle activity (low- to moderate-intensity) that is enjoyable; move more; sit less

- *Frequency and duration:*

- Start with short bouts of walking (5 to 10 min at a time), 5 to 6 days weekly; increase to 10 minutes, 3 times a day, faster speed

- *Progression:*

- Goal of 150 to 300 minutes moderate to vigorous exercise spread throughout the week



## Case study: questions to answer

### **2. What precautions would you suggest?**

- Monitor blood glucose before and after exercise
- Start with exercise at a low intensity
- Progress slowly with structured activities to avoid the development of activity-related injuries, exercise nonadherence, or lack of motivation
- Increase amount of physical activity gradually over a period of weeks to months as able and willing
- Carry a form of carbohydrate during activity

## Case study: questions to answer

### **3. What strategies might you suggest to help motivate and support her efforts to establish regular physical activity as a lifelong habit?**

- Behavior-change strategies appropriate to “contemplation” and “preparation” stages
- Set SMART goals to enhance self-efficacy
- Motivational interviewing
- Use of a pedometer, accelerometer, or other tracking tool
- Social media (to share results and get encouragement)

## Key activity take-aways

- Encourage regular physically activity for metabolic health
- Recommend both aerobic and resistance exercise to maximize muscle mass and insulin action
- Include flexibility exercise, along with neuromotor/balance training for older adults
- Move all day long, and break up sedentary time frequently
- Start out slowly and progress slowly
- Stay physically active to live long and well

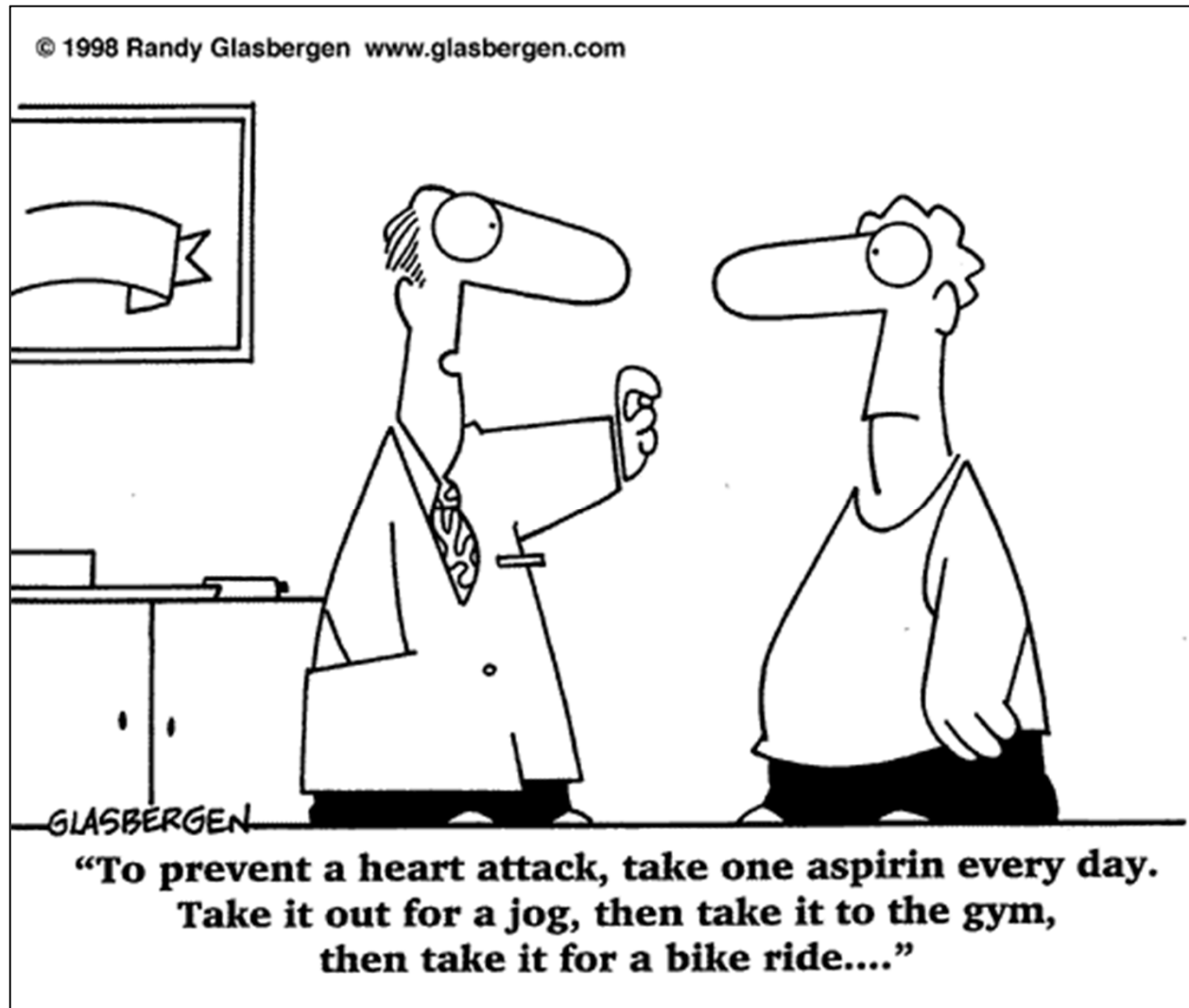


## A few parting thoughts

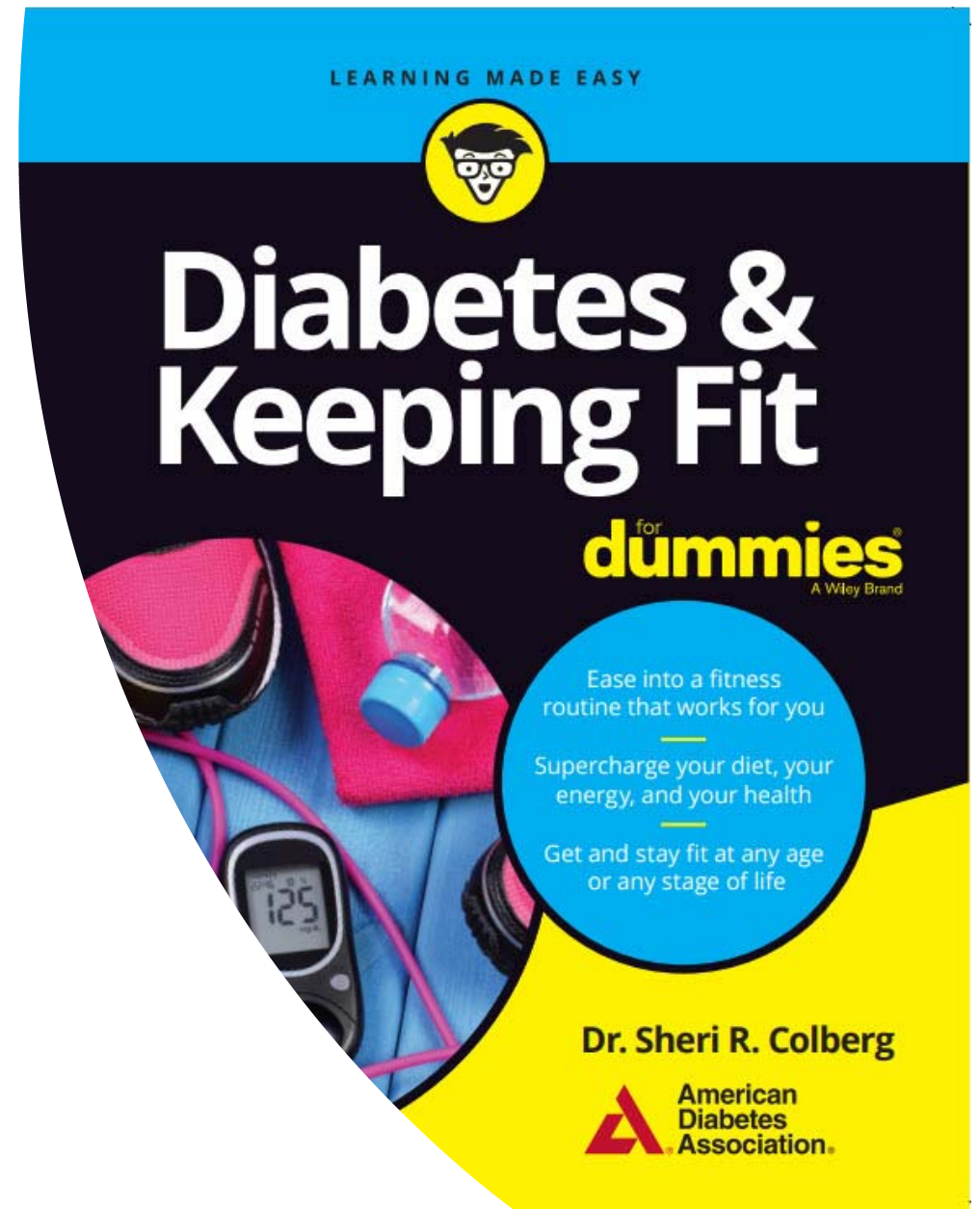
Work to enhance the following your patients:

- Self-efficacy (i.e., confidence in being active)
- Enjoyment of physical activity
- Reduced perceived barriers to being active
- Positive beliefs concerning the benefits of activity
- Support from others to continue exercising

Exercise is the best medicine!



# Resources



# ADA position statement

## Physical Activity/Exercise and Diabetes: A Position Statement of the American Diabetes Association

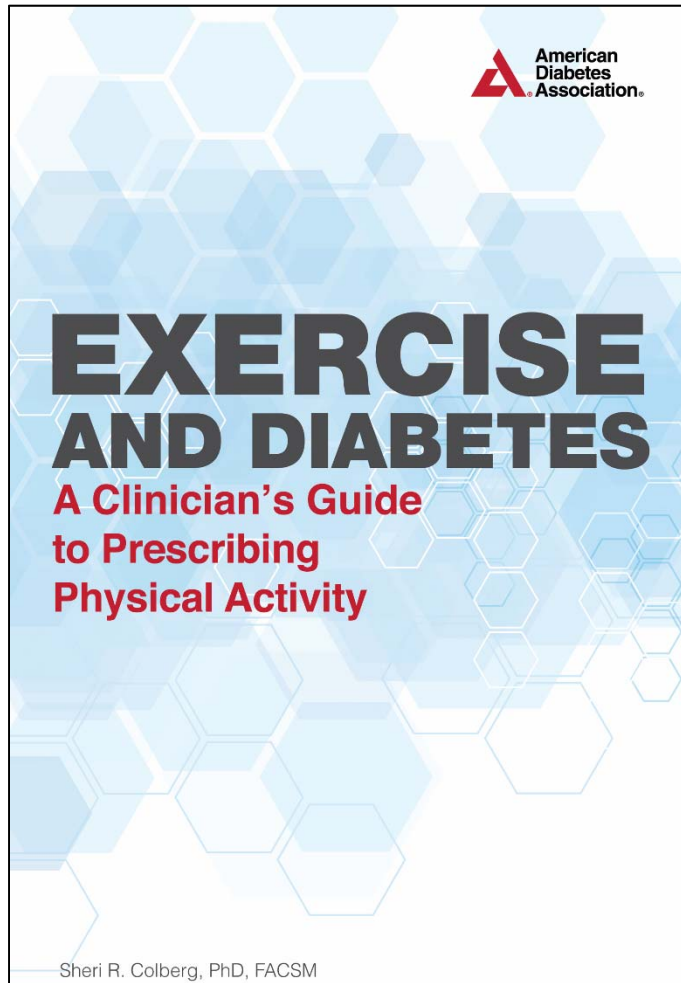
*Diabetes Care* 2016;39:2065–2079 | DOI: 10.2337/dc16-1728

*Sheri R. Colberg,<sup>1</sup> Ronald J. Sigal,<sup>2</sup>  
Jane E. Yardley,<sup>3</sup> Michael C. Riddell,<sup>4</sup>  
David W. Dunstan,<sup>5</sup> Paddy C. Dempsey,<sup>5</sup>  
Edward S. Horton,<sup>6</sup> Kristin Castorino,<sup>7</sup> and  
Deborah F. Tate<sup>8</sup>*

The adoption and maintenance of physical activity are critical foci for blood glucose management and overall health in individuals with diabetes and prediabetes. Recommendations and precautions vary depending on individual characteristics and health status. In this Position Statement, we provide a clinically oriented review and evidence-based recommendations regarding physical activity and exercise in people with type 1 diabetes, type 2 diabetes, gestational diabetes mellitus, and prediabetes.

Physical activity includes all movement that increases energy use, whereas exer-

# A clinician's guide to exercise and diabetes



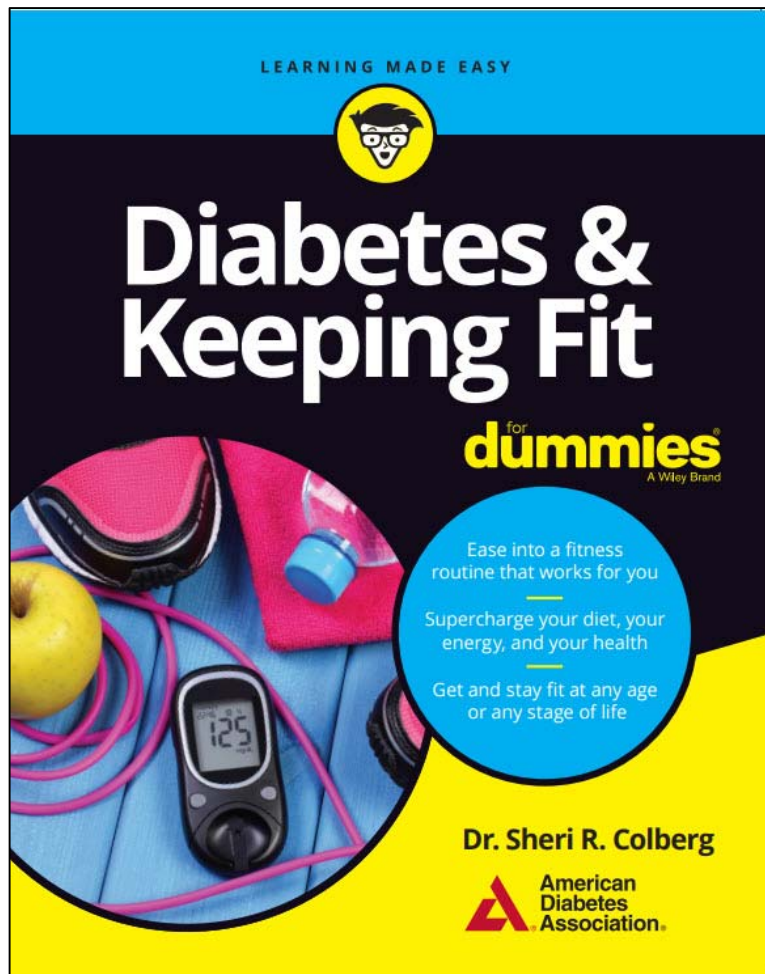
*Exercise and Diabetes:  
A Clinician's Guide to  
Prescribing Physical  
Activity*

Dr. Sheri R. Colberg

American Diabetes  
Association © 2013



A diabetes/exercise guide for everyone

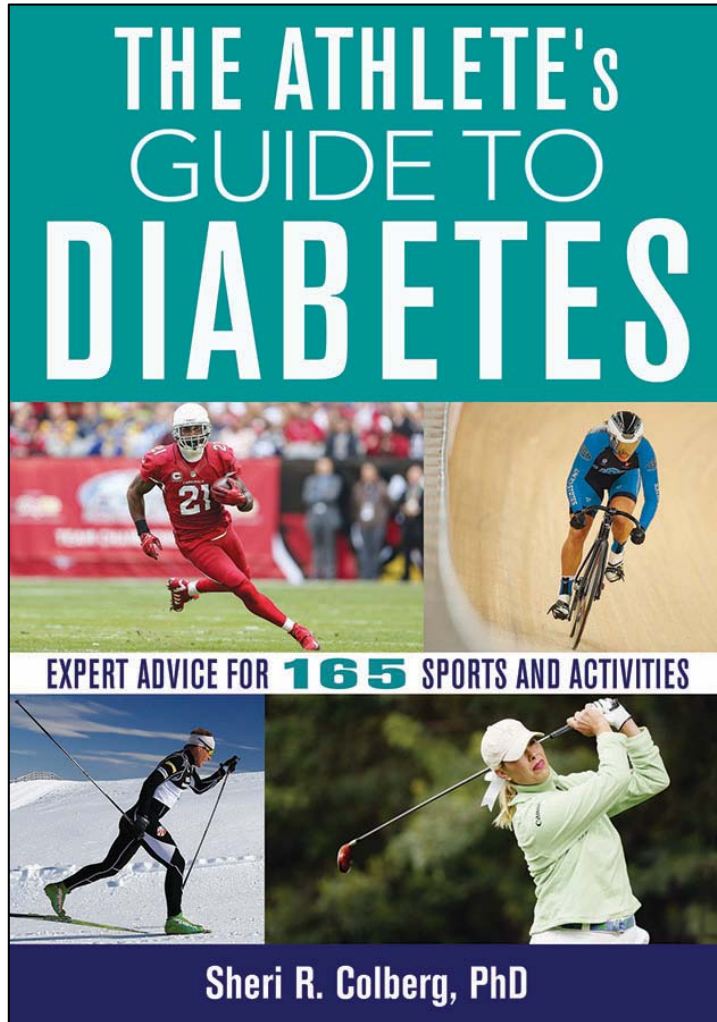


*Diabetes & Keeping Fit  
for Dummies*

Dr. Sheri R. Colberg

Wiley © 2018

An exercise guide for insulin users



*The Athlete's Guide to  
Diabetes*

Dr. Sheri R. Colberg

© 2019

Human Kinetics

Real-life athletes examples  
and training profiles

# More free information online

The screenshot shows the website [www.diabetesmotion.com](http://www.diabetesmotion.com). The navigation menu includes Home, About, Choose Your Motion, Diabetes Motion Basics, Motion Specifics, Resources, Blog, and More. The main content area features a large background image of a surfer riding a wave. On the right side, there is a white box with a blue border containing the following text: "JOIN THE ACTIVITY REVOLUTION & GET YOUR DIABETES MOTION™". Below the text is a circular image of a woman in a yoga pose on a rock. Underneath the image, it says: "Whether you're new to exercise or a sports enthusiast, diabetes can get in the way of being physically active. Learn how to catch the next wave." At the bottom of the box is a button that says "Catch the Wave >>". To the left of the white box are social media icons for Facebook, Twitter, and Google+. At the bottom of the page, there are social media sharing buttons for Like, Share, Tweet, Pin it, and G+.

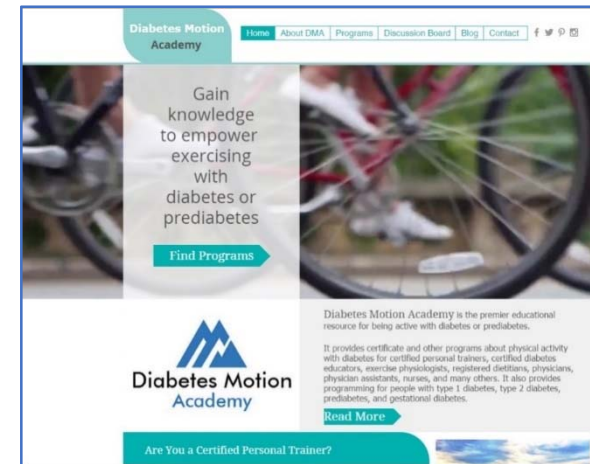
[www.DiabetesMotion.com](http://www.DiabetesMotion.com)

# Courses for continuing education and credits

## ***Exercise and Diabetes***

- Courses by Dr. Sheri Colberg
- 3-level online program for fitness and other health professionals
- Earn credit hours for completion

**[www.DMAcademy.com](http://www.DMAcademy.com)**



*Thank you*

scolberg@odu.edu