

HIIT: High-intensity interval training

can boost health,
well-being



Experts affirm this training protocol can be adapted for all ages and fitness levels

by Marilyn Larkin, MA

The term *HIIT* strikes fear into the heart of many who are unfamiliar with the concept and assume any kind of high-intensity workout program isn't suitable for them or the older adults they work with. Yet that's definitely not the case, according to the experts interviewed for this feature. Drs. Mary E. Sanders, John J. Ratey, Len Kravitz and Martin Gibala, as well as Cris Dobrosielski, all support the safe use of HIIT with people over 50 (see accompanying sidebars).

To help *Journal on Active Aging*® readers gain a better understanding of HIIT and how and why it can benefit their constituencies, we turned first to Dobrosielski, CSCS, CPT, CHC, MT, a consultant and spokesperson for the American Council

on Exercise (ACE), and internationally recognized expert in health, fitness, sport performance and injury prevention.

An accomplished athlete who has earned five Masters World Championships and nine Masters National Championships in surf lifesaving events, Dobrosielski is author of *Going the Distance: The Three Essential Elements of Optimal Lifelong Fitness and Injury Prevention* (refer to "Resources" on page 40 for information). He also owns San Diego, California-based Monumental Results, his fitness training, human performance and coaching business.

A number of Dobrosielski's clients are over age 70, and he has found ways to make HIIT work for them. We asked him to explain the basics and give advice on getting started.

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ML: *What specifically is HIIT, and how can it help older adults?*

CD: HIIT is simply a form of interval training—a series of work and rest periods done in prescribed intervals. Although the protocol is often used to improve cardiorespiratory fitness, it can also be done to improve strength, on land and also in the water. [Ed. Learn more about water HIIT in the sidebar on page 39.]

HIIT is considered “high intensity” because when this training is done for cardiorespiratory benefits, individuals typically work between 80% and 95% of their ability or maximum heart rate. If HIIT is done for strength as well as cardiorespiratory benefits, the person does as many repetitions of a major muscle group exercise as possible, in a brief time frame, while maintaining sound technique.

But HIIT is flexible, as long as periods of work are alternated with periods of rest. The work interval must be sustainable—typically, somewhere between 10 and 30 seconds for most populations.

The other important part is the rest period. There has to be a sufficient work-to-rest ratio that is doable. That generally means a one-part work period and about a two- or three-part recovery period. So if someone is exercising continuously between 80% and 95% of capacity for 15 seconds, then the rest period will last for 30–45 seconds. That cycle is repeated for 10–20 minutes.

“Rest” doesn’t mean sitting down; it means continuing to move in the neighborhood of 40–50% of one’s maximum heart rate or of the perceived exertion [how hard the person feels his/her body is working]. It’s very much active recovery, going at a pace at which the person can keep up a conversation. On a treadmill or bicycle, that pace is typically a bit more than just keeping the wheels

spinning; on a StairMaster or an elliptical machine, it’s a little more than just keeping the legs moving.

For older populations, it’s important to factor in medications such as beta blockers, which produce lower baseline heart rates. Here’s where perceived exertion is particularly important, since the absolute numbers (what constitutes 80–95% of capacity) will be lower than you might expect.

As for benefits, studies have shown that HIIT significantly increases fitness, reduces body fat and improves conditions such as diabetes. [Ed. See the sidebar “HIIT benefits and concerns” on page 40 for further information, plus view “Resources” on that page for a selection of recent studies on HIIT with older adults.]

ML: *Does someone have to prepare for HIIT, or can you jump right in and do it?*

CD: First, individuals who consider embarking on HIIT or any challenging exercise program should be cleared by a doctor, especially if they haven’t exercised in a while. Then, a base level of training is helpful, for orthopedic safety, neurological accommodation to the specific exercise mode, and reduced risk of extreme soreness in the days that follow.

Start with light aerobic activity, some dynamic and static flexibility training and some basic resistance training to help acclimate the body over a period of a few weeks. That preparation will also make participants aware of any problems with hips, wrists, low back, or other joints—areas that may require additional strengthening or special attention.

It’s important to remember that with adults over 70 in particular—even those who are well trained—every action has multiple reactions. So if you change one aspect of an exercise to make it a bit harder, such as increasing the angle on

a leg exercise, this may lead to unanticipated pain or strain for someone who is unprepared.

Begin by introducing exercises that are safer bets. For example, for the active-rest segment between resistance exercises, it’s safer to start someone who hasn’t been very mobile on a stationary bike and increase the resistance there than it is to put them on a treadmill, where raising the incline or speed can also raise the risk of falls. The goal is safe intensity.

ML: *How long is a HIIT session?*

CD: Overall, most sessions will last about 30 minutes. Every HIIT workout should start with a warm-up and end with a cooldown, each of which will run about 5–10 minutes. For the warm-up, prepare the body with some low-intensity aerobic exercise, increasing the heart rate slowly. If the session involves HIIT strength-training, have participants do some dynamic stretches for arm, leg and torso movements that they’ll do during the session, again to ensure that the body can perform at a high level and extract the most benefits possible.

The cooldown is also critical. With a high level of exertion, the body will focus blood flow away from the heart and into the extremities, so we need to bring it back with some easy aerobic exercise such as walking or cycling, and then some light static stretching and/or mobility exercises, to decrease the likelihood that the neck, shoulders, low back, and other joints will feel beat up the next day.

The high-intensity piece generally lasts 12–20 minutes, depending on the individual, and his/her level of experience and fitness. As is the case for every exercise program, participants should use good posture and form throughout the workout. Losing form can be a sign that the individual is going beyond his or her capacity.

ML: *How many times a week should someone do HIIT?*

CD: There should be a bare minimum of a day between HIIT sessions, but for older populations, that's definitely pushing it. And since HIIT is not the only thing they should be doing—we also want to increase flexibility, improve balance and function—my older clients might do a HIIT session on a Monday, then on Tuesday, something less challenging such as riding a bike, going for a walk or taking a yoga or pilates class. They might come back on Wednesday

for a moderate workout session; on Thursday, they would do something similar to Tuesday, and then they might have another HIIT session or simply a more intense workout session on Friday.

I let my clients drive the structure, so they feel safe while progressing at a reasonable level and pace.

ML: *Can HIIT be done in a group, rather than in individual sessions?*

CD: Sure. Again, safety is key. We need to pick exercises that people can do with

a moderate amount of supervision—for example, half a dozen full-body weightlifting exercises, such as push-ups, overhead press, squats or lunges. In between each of those, for recovery, they would engage in some easy aerobic exercises.

So participants might do a set of push-ups for 15 or 20 seconds, then hop on an exercise bike or walk on a track for 60 seconds. They would go back to strength-training—maybe overhead press instead of push-ups—followed

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HIIT and the brain

John J. Ratey, MD, is a clinical associate professor of psychiatry at Harvard Medical School, an internationally recognized expert in neuropsychiatry, and author of more than 60 peer-reviewed journal articles and 11 books, including *SPARK: The Revolutionary New Science of Exercise* (see “Resources” on page 40).

Ratey started doing HIIT in 2007, “when I read studies talking about the incredible changes we see with it, both in the body and in the brain,” he says. Studies had already shown that exercise helps balance key neurotransmitters (chemicals that transmit signals across brain cells), including:

- glutamate, which stimulates nerve cell activity
- gamma-amino butyric acid (GABA), which inhibits that activity
- serotonin, which helps keep in check unbalanced brain activity that leads to depression, anxiety and obsessive-compulsive disorder

- norepinephrine, which influences motivation, attention and perception
- dopamine, which influences learning, the brain's reward system, as well as attention and movement

Exercise balances these neurotransmitters by increasing brain-derived neurotrophic factor (BDNF), a protein that nourishes neurons, according to Ratey.

But HIIT carries everything one step further, by stimulating the pituitary gland to release more human growth hormone (HGH). Ratey describes HGH as “the body's master craftsman.” Not only does this hormone “pump up brain volume,” he says, but it also helps burn belly fat and stimulates growth of the endothelium, the covering around the arteries, as well as small vessels called arterioles.

One of the first HIIT studies that caught Ratey's attention showed that after adult participants went “all out” on a bike, their HGH rose to levels seen in adolescents. “At that level,” he says, “you don't

just help the brain; you also kick out plaques in the arteries.”

In a talk that impressed ICAA CEO Colin Milner, Ratey likened HIIT's actions on the arteries to a Roto-Rooter-type plumbing product, which is used to unclog drains.

Ratey, now 69, embarked on his own HIIT program, which involved six treadmill sprints within a 20-minute period, balanced by lower-intensity treadmill walking during active rest. “I lost 12 lbs. and was in great shape,” he says. The author and professor kept up his HIIT workouts two or three times weekly for several years, but now does a session once every week or so.

“It's not something I look forward to,” Ratey acknowledges. “But it gets easier as you go along, and the benefits are undeniable.”

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'The One-Minute Workout'

To understand a bit of the science behind HIIT as well as its appeal, the *Journal on Active Aging* turned to Martin Gibala, PhD, a professor and chair of the Kinesiology Department at McMaster University in Hamilton, Ontario, Canada. Gibala's research on the physiological and health benefits of HIIT has attracted scientific attention worldwide. He is also the principal author of the recently published book *The One-Minute Workout: Science Shows a Way to Get Fit that's Smarter, Faster, Shorter*, which includes eight interval workouts and four micro workouts, some of which may be suitable for older populations.

Gibala, a long-time HIIT enthusiast and researcher, explained that the one-minute HIIT workout is made up of three 20-second bursts of very vigorous exercise interspersed with two minutes of recovery. The protocol hasn't been tested in older adults and probably isn't suitable for those who are deconditioned or have cardiometabolic conditions.

That said, "the focus of the book is really time-efficient interval training protocols that have been applied to different groups of individuals," Gibala notes. "Interval training comes in lots of different flavors and varieties. It's not just 'all-out, hard as you can go' exercise."

According to Gibala, "Many more people than we might think can perform interval training and benefit from it. And it has been shown to be effective in older adults," he adds, "including those with heart disease, type 2 diabetes and metabolic syndrome."

A good starting point for older individuals is interval walking, Gibala

advises. Studies comparing interval walking and continuous walking at modest intensities (about 66% of maximum heart rate) have shown that interval walking provides greater benefits in terms of a fitness boost, improved blood-sugar control and improvements in body composition.

The beginner walking workout below, one of several in Gibala's book, is based on a study by the Mayo Clinic and Japan's Shinshu University. The study showed that three months of interval walking done four times weekly increased participants' cardiorespiratory fitness by more than 25% and triggered a 6% lowering of systolic (first number) blood pressure.

Study participants were out-of-shape men and women in their mid-fifties. The protocol has also been used with people in their late seventies who were so deconditioned they could not walk for more than three minutes at a time.

The modified HIIT workout is simple:

1. Warm up by walking at an intensity of 1 (on a scale of 0—no exertion at all—to 10+).
2. Increase your effort to intensity 3, where you are breathing deeply but can still hold a conversation. Maintain that pace for three minutes.
3. Ease back to intensity 2 for three minutes.
4. Repeat steps one to three for a total of 30 minutes.

Participants who can't manage 30 minutes of interval walking right away should simply start with as many repetitions as they can manage and work their way up, Gibala concludes.

again by an aerobic exercise, either the same one or maybe jumping jacks or light skipping.

The key is to have the resources—the room and/or the equipment—to do the easier pieces in between the strength-training pieces. Participants can't do an intense set of squats and then do push-ups or a bench press. The program would be more like squats for 15 or 20 seconds, followed by light walking for 45–60 seconds, and then back to full- or upper-body exercises. Cycle through these several times in a 30-minute session that includes both a warm-up and a cooldown.

ML: *How do you explain HIIT to your clients the first time you want to use it with them?*

CD: Frankly, if you asked my older clients if they enjoy doing HIIT training with me, they would look at you cross-eyed. I simply give it to them as their training session without labeling it. HIIT is a stimulating way to train, and it doesn't take a lot of time. You select appropriate exercises, identify the right length of time or number of repetitions, and give breaks between intervals.

People have to trust themselves to be able to do the exercises at the level you're asking them to do. They have to trust you to know that you're not asking them to do more than they actually can do. You don't just cross your fingers and hope that this 70-year-old or this 80-year-old individual can pull it off. It comes down to knowing your clients and understanding what their 80–95% looks and feels like.

We know that another real benefit of HIIT training, if done properly, is that participants can accomplish more and benefit more in a shorter workout—and that boosts the likelihood of adherence to exercise and consistency. If we scare people away by giving them too much,

too fast in the way of intensity, then we lose them. And we've lost the opportunity to help them change their behavior for the rest of their life rather than just for a short session.

ML: *What else do people need to be aware of if they are doing HIIT with older adults?*

CD: Given that the physical demands on participants are going to be greater, you need to be aware of the temperature in the room you're working in. Most recommendations are somewhere between 68 and 73 degrees. If people are working hard, they need some moving air; it can't be 80 degrees because it happens to be

summer and you're doing HIIT in the dining room.

Participants need to be well-hydrated and well-fed going into these workouts. If clients are rushing to get to their mid-morning exercise class and they skipped breakfast and are dehydrated, there's more risk if they're doing HIIT than if they're just going out for a stroll, where they can get by on less since the intensity is lower.

The other important point is that even though I take a sensible approach to HIIT, and understand that it needs to be adapted to the individual as much as possible, I nonetheless am convinced

that HIIT training is a terrific program for just about everyone. Even with adaptations, HIIT has considerable physiological benefits [see sidebar]. It's also a highly motivating way to work out, at any age. *W*

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Water HIIT



A participant goes 'all out' with water intervals. Photo: Katrien Lemahieu. Image courtesy of WaterFit

Mary E. Sanders, PhD, FACSM, RCEP, a registered clinical exercise physiologist at the Division of Wellness and Weight Management in the School of Medicine at the University of Nevada, Reno, and an International Council on Active Aging® Advisory Board Member, is well known to many *Journal on Active Aging* readers as a frequent contributor on water training.

The director of WaterFit™/Wave Aerobics® and Golden Waves® and editor/coauthor of the book *YMCA Water Fitness for Health*, Sanders was an early convert to HIIT, which she adapted for the water as “higher-intensity” interval training.

One of Sanders' studies involved older adults who participated in Golden Waves, her interval-training program that focuses on strength, function and range of motion. After four months, participants improved significantly in balance, agility, sit-to-stand, stair climbing and walking speed.

“We never said, ‘You have to reach 90% of your maximum heart rate,’” Sanders emphasizes. “We said, ‘Do as much as you can—until it feels like you're huffing and puffing.’ We gave them cues to push them along. By the end of the study period, they were already in the pool when I arrived.”

Sanders observes, “What I learned is that we underestimate what our constituents are willing and able to do, and the power they have inside when they're motivated.” Also, “the peer support within the group is amazing,” she says.

In another recent study, Sanders and her colleagues reviewed studies on water HIIT and included sample exercises and a sample program using Sanders' S.W.E.A.T. method. For the shallow-water workout, participants are asked to work in water that reaches approximately to the xiphoid (lower part of the chest), and to start by practicing moves at slow

speeds with proper posture and alignment. Individuals gradually increase their speed and effort, thereby adapting progressively to higher resistance. To implement the protocol:

1. Choose a basic coordinated move in which arms and legs work together—for example, scissors for three minutes followed by hover jogs for two minutes (webbed gloves can assist with stabilization and “gripping” the water for better movement quality).
 - For scissors, arms should push and pull in opposition to legs.
 - Hover jogs combine a jump followed by six quick jogs before landing—that is, participants hover over the bottom of the pool, with hands on the surface for balance.
2. Recommended intervals are: 15 seconds at a moderate pace, 15 seconds at a hard-to-very hard pace (increase speed), 15 seconds at an easy pace. Repeat the intervals using a different variation or change the basic move.

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HIIT benefits and concerns

International fitness expert and educator Len Kravitz, PhD, says HIIT has cardioprotective effects. “Research shows high-intensity interval training can lower blood pressure and improve cardiovascular health,” states Kravitz, associate professor and program coordinator of exercise science at the University of New Mexico, Albuquerque. “HIIT can improve insulin sensitivity, which means it helps the exercising muscles more readily use glucose for fuel utilization. It has also been confirmed to improve ‘good’ or HDL cholesterol, and to help lower ‘bad’ or LDL cholesterol.” In addition to enhancing aerobic and anaerobic fitness, “HIIT workouts also help to reduce abdominal fat and promote weight reduction,” he adds.

“As to caveats, safety is the key concern,” Kravitz continues. “Safety in participation should always be the number one priority, and people should focus more on finding their own optimal training intensities as opposed to keeping up with other persons.” When a “safety first” approach is used, he stresses, “HIIT is a viable exercise opportunity for older adults.”

For an overview of HIIT, refer to the 2014 brochure written by Dr. Kravitz for the American College of Sports Medicine (see “Resources” on this page).

Resources

Internet

John Ratey, MD

<http://www.johnratey.com>

McMaster University: Martin Gibala, PhD

<https://www.science.mcmaster.ca/kinesiology/people/faculty/191-martin-gibala.html>

Monumental Results, Inc.

<http://monumentalresults.com>

Sparking Life

<http://www.sparkinglife.org>

University of Nevada, Reno School of Medicine’s Division of Wellness and Weight Management: Mary E. Sanders, PhD

<http://med.unr.edu/directory/mary-sanders?v=bio#Biography>

University of New Mexico: Len Kravitz, PhD

<https://www.unm.edu/~lkravitz>

Multimedia

Healthy Learning: Mary E. Sanders: “WaterFit” DVD

<https://www.healthylearning.com/m-3078-mary-sanders.aspx>

Healthy Learning: Mary E. Sanders & Cathy Maloney-Hills: “The Golden Waves” Program: Functional Water Training for Health” DVD

<https://www.healthylearning.com/searchadv.aspx?SearchTerm=Golden+waves>

YouTube: “Run, Jump, Learn! How Exercise Can Transform our Schools: John J. Ratey, MD, at TEDxManhattanBeach”

<https://www.youtube.com/watch?v=hBSVZdTQmDs>

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Gibala, M., & Shulgan, C. (2017). *The One-Minute Workout: Science Shows a Way to Get Fit that’s Smarter, Faster, Shorter*. New York, NY: Avery, an imprint of Penguin Random House, LLC

Kravitz, L. (2014). ACSM Information On ... High-Intensity Interval Training. Indianapolis, IN: American College of Sports Medicine. Available at <https://www.acsm.org/docs/brochures/high-intensity-interval-training.pdf>

Ratey, J. J., & Hagerman, E. (2008). *Spark! The Revolutionary New Science of Exercise and the Brain*. New York, NY: Little, Brown and Company

Sanders, M. E. (2011). Dive into the deep for head-to-toe resistance training [includes the S.W.E.A.T.™ method]. *Journal on Active Aging*, 10(1), 90–100; January/February 2011. Available to ICAA members in the online content library [“Wellness articles,” “Aquatics” category] at www.icaa.cc

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Recent research

HIIT is a burgeoning area of research. Studies cover everything from basic research on mitochondria—considered the cell's power generators, converting oxygen and nutrients into adenosine triphosphate (commonly known as ATP)—to the impact on specific diseases such as diabetes. Following is a short selection of recent HIIT studies relevant to older adults provided by the experts interviewed for this feature:

Francois, M. E., Durrer, C., Pistawka, K. J., et al. (2016). Resistance-based interval exercise acutely improves endothelial function in type 2 diabetes. *American Journal of Physiology: Heart and Circulatory Physiology*, 311(5), H1258–H1267. doi: 10.1152/ajpheart.00398.2016

Karlsen, T., Aamot, I-L., Haykowsky, M., & Rognmo, O. (In press). High-intensity interval training for maximizing health outcomes. *Progress in Cardiovascular Diseases*. doi: 10.1016/j.pcad.2017.03.006

Karstoft, K., Winding, K., Knudsen, S. H., et al. (2013). The effects of free-living interval-walking training on glycemic control, body composition, and physical fitness in type 2 diabetic patients. *Diabetes Care*, 36(2), 228–236. doi: 10.2337/dc12-0658

Lalande, S., Okazaki, K., Yamazaki, T., et al. (2010). Effects of interval walking on physical fitness in middle-aged individuals. *Journal of Primary Care &*

Community Health, 1(2), 104–110. doi: 10.1177/2150131910363598

MacInnis, M. J., & Gibala, M. J. (2016). Physiological adaptations to interval training and the role of exercise intensity. *Journal of Physiology*, 595(9), 2915–2930. doi: 10.1113/JP273196

Nagle, E. F., Sanders, M. E., & Franklin, B. A. (2017). Aquatic high-intensity interval training for cardiometabolic health: benefits and training design. *American Journal of Lifestyle Medicine*, 11(1), 64–76. doi: 10.1177/1559827615583640

Robinson, M. M., Dasari, S., Konopka, A. R., et al. (2017). Enhanced protein translation underlies improved metabolic and physical adaptations to different exercise training modes in young and old humans. *Cell Metabolism*, 25(3), 581–592. doi: 10.1016/j.cmet.2017.02.009

Sanders, M. E., Takeshima, N., Rogers, M. E., et al. (2013). Impact of the S.W.E.A.T.™ water-exercise method on activities of daily living for older women. *Journal of Sports Science & Medicine*, 12(4), 707–715.

Sculthorpe, N. F., Herbert, P., & Grace, F. (2017). One session of high-intensity interval training (HIIT) every 5 days, improves muscle power but not static balance in lifelong sedentary ageing men: A randomized controlled trial. *Medicine*, 96(6), e6040. doi: 10.1097/MD.0000000000006040

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