



Continuing Education Course



Improving Cardiovascular Health and Fitness

BY SHAWN PERRY



To earn continuing education credits you must successfully complete the course examination.
The cost for this CE exam is \$25.00. For group rates, call (973) 251-5055

Improving Cardiovascular Health and Fitness

Educational Objectives

On completion of this course, students will:

- Describe the difference between cardiovascular and health and fitness
- Describe the elements of a proper pre exercise evaluation
- Gain and understanding of proper exercise intensity/effort through heart rate
- Identify the types of improvements in cardiovascular health

BY SHAWN PERRY

HOW DO WE AS FIREFIGHTERS DEFINE AND MEASURE our cardiovascular health and fitness? How do we determine if we are fit and healthy enough to perform the demands of our profession and survive?

Traditional fire service, military, and other public safety entities emphasize performance-based protocols (i.e., timed running events) to evaluate cardiovascular health and fitness. This may be a commonsense and an economical approach for evaluating cardiovascular fitness early in our careers, but risk profiles change with aging. Relying on activity-based cardiovascular assessments becomes problematic at best and dangerous (even deadly) at worst.

Age, injury accumulation, heredity, and lifestyle take their toll, particularly in our profession as we face unpredictable and extraordinary physical demands under very stressful conditions. As our careers progress, however, our effectiveness shifts from relying on peak physical capabilities to more refined skills and efficient operations. It's called experience, a natural evolution that allows us to survive our profession for two to three decades.

To a certain extent, elite athletes attempt to do the same through advanced training methods, sound nutritional practices, and continued skill refinement. Brett Favre certainly is no longer at his physical peak, but he had one of the best seasons of his career in his late 30s. We may find this exceptional for a professional athlete, but in fire service terms, Brett Favre might only be halfway through his career!

CARDIOVASCULAR HEALTH VS. CARDIOVASCULAR FITNESS

When we discuss heart attacks (the number-one cause of firefighter line-of-duty deaths, at 47 percent annually), we are really talking about a catastrophic failure resulting from a

chronic deteriorating condition. Contrary to popular descriptions, heart attacks are generally not a result of overexertion (a fitness issue); they result from poor cardiovascular health that has developed in the individual firefighter over many years. Although the terms “cardiovascular health” and “cardiovascular fitness” are often used interchangeably, they have very different meanings and evaluation criteria.

Cardiovascular fitness is defined by measuring an individual's work output (sub-maximal) over a period of time through a controlled exercise modality (i.e., running on a treadmill, step test, etc.). Physicians and exercise physiologists measure our performance over time and interpret that information as our ability to use oxygen (O_2). This performance type is very different from a maximal power measurement, such as weight lifting or performing a short sprint. These short-burst activities use the anaerobic (without O_2) energy systems and do not necessarily correlate with cardiovascular health or fitness. A high level of aerobic/cardiovascular fitness, however, will enhance recovery time between anaerobic activities.

The body's O_2 use is measured in milliliters of O_2 per kilogram of body weight per minute ($ml/O_2/kg/min$). In other words, no matter what your size, you are assessed according to your ability to produce based on your weight, which is why running is one of the most common methods of measuring O_2 use.

Based on performance studies involving both specific firefighting activities and general activities such as running, the consensus among physicians and exercise physiologists is that firefighters need to be able to use 42 to 44 $ml/O_2/kg/min$. This performance parameter allows us to perform our duties effectively yet retain a reserve capacity for extended work periods or sudden maximal exertion. In running terms, this equates to jogging at an eight-minute-mile pace for 1½ miles (12 minutes total).

Note: Do not go out and time yourself on a track today unless you are fit and have been running. Running performance

is not necessarily an accurate or direct predictor of fireground performance capabilities. It may have relevance, but running does not cover all the various activities and associated muscular demands on the human body while firefighting.

The health component of cardiovascular assessment describes the functional condition of all the components of the cardiovascular system (heart, lungs, and vascular network); it's the ABCs (airway, breathing, circulation) of the body. For engineers, it's like an air-intake system, the pump, and the hose. If you have a large air-intake capacity (lungs), a big pump (heart), and large-diameter hose (vascular system), you can produce a lot of work without permanently damaging your body. You may still reach a point of maximum work capacity (physical exhaustion), but ultimately you will recover and survive the event. People who win marathons don't die at the finish line.

Medically based assessments of the cardiovascular system include measuring electrical heart functions (ECG), narrowing and hardening of the vascular walls, and blood lipid levels. Medical screening tools, such as a resting 12-lead electrocardiogram, various blood panels, and more invasive procedures (chest x-rays, heart scans), may reveal medical issues that require a more complex and monitored approach to correcting a dangerous situation.

Poor cardiovascular fitness ultimately leads to poor cardiovascular health. However, good cardiovascular fitness does not guarantee a clean bill of health. A firefighter may be able to run a marathon, but conditions including heredity, lifestyle choices, job exposures, stress, and hidden cancers may take a silent toll that can still lead to poor cardiovascular health. There are no guarantees, but we must subscribe to the proven concept that addressing cardiovascular fitness gives us the best probability of supporting cardiovascular health.

READY! SET! HOLD ON!

You may be ready, or at least motivated, to fly out the door and do stadium stairs, and exercise is definitely a part of the "success equation," but you need to evaluate yourself first. Unless you are 25 years old and fresh out of the academy (where you ran six-minute miles), you must visit with your physician for a basic medical exam that includes the following:

1. A review of your family medical history, including physical and cultural heredity.
2. A basic orthopedic exam (bone, muscle, connective tissue, joints, etc.).
3. Physiological parameters (blood pressure, heart rate, resting 12-lead ECG).
4. Body composition assessment and discussion.
5. Blood lipid profile (cholesterol).
6. If you are over age 40 or if you have existing medical conditions such as hypertension, do a graded exercise sub-maximal treadmill test with a 12-lead ECG. You might need to push for this test with your physician.

If you are older and have issues that preclude you from running, or you simply hate to run, some other options that will bring similar desired results include power walking, biking and spin classes, swimming, aerobics, hiking, elliptical train-

ing, and rowing. These standard options and other modalities certainly exist, but the common features are based on a generally accepted definition of cardiovascular exercise among exercise physiologists.

Cardiovascular exercise is generally defined as using the major muscle groups of the body in a continuous motion for at least 20 minutes. This fundamental definition has existed for a few decades and stands as the reference for improving and maintaining cardiovascular fitness. However, there are recent studies that also conclude that shorter bouts of intermittent exercise throughout the day can have a positive effect on the cardiovascular system. The message is that "some is better than none," and our nation needs to seriously address some level of commitment to prevention through exercise and better nutrition, especially for firefighters.

ESTIMATING APPROPRIATE EFFORT AND INTENSITY

Cardiovascular exercise intensity is commonly determined by measuring heart rate. Your target heart rate during exercise should be anywhere between 60 and 80 percent of your estimated maximum heart rate. Your maximum theoretical heart rate is calculated by subtracting your age from 220. For example, a 40-year-old person has a theoretical maximum heart rate of 220 minus 40, or 180 beats per minute. Multiply this estimate by 60 to 80 percent, and you have a target heart rate of between 108 and 144 beats per minute during your exercise session. Each person is different, however, and these figures will vary among individuals.

HOW WE IMPROVE

No matter what your age, if you make an appropriate effort to improve your condition, your body will respond positively. You may not embrace the initial physical discomfort, but eventually this subsides and gives way to a feeling of empowerment and self-control; you stop being a passive victim of our profession and you take control of your life.

Each cell in your body is under constant reconstruction/replacement. Most of your body's cells today will be gone and replaced in three to six months. In fact, your body produces and replaces approximately two million red blood cells per second! The point is that each replaced cell can be influenced by your activity level and what you eat. The energy-producing component of each cell in your body is the mitochondria. Mitochondria combines O_2 and sugar (CHO) to produce energy, carbon dioxide (CO_2), and water (H_2O).

Each cell contains varying numbers of mitochondria. Muscle cells, including the heart, have extremely high mitochondria concentrations when compared with other cells in the body because of the constantly produced work. A person in poor cardiovascular condition has a lower concentration of mitochondria per cell than a fit person. Exercising sends your brain a message to crank up the number of powerhouses per cell. This is only one example of the many positive physiological changes that occur when you place physical demands on your body.

Some physical benefits include improving your heart's stroke volume (the amount of blood pumped by the right/left ventricle of the heart in one contraction), your vascular system's elastic-

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COURSE EXAMINATION INFORMATION

To receive credit and your certificate of completion for participation in this educational activity, you must complete the program post examination and receive a score of 70% or better. You have the following options for completion.

Option One: Online Completion

Use this page to review the questions and mark your answers. Return to www.FireEngineeringUniversity.com and sign in. If you have not previously purchased the program, select it from the "Online Courses" listing and complete the online purchase process. Once purchased, the program will be added to your **User History** page where a **Take Exam** link will be provided. Click on the "Take Exam" link, complete all the program questions, and Submit your answers. An immediate grade report will be provided and on receiving a passing grade your "Certificate of Completion" will be provided immediately for viewing and/or printing. Certificates may be viewed and/or printed anytime in the future by returning to the site and signing in.

Option Two: Traditional Completion

You may fax or mail your answers with payment to *PennWell* (see Traditional Completion Information on following page). All information requested must be provided to process the program for certification and credit. Be sure to complete ALL "Payment," "Personal Certification Information," "Answers," and "Evaluation" forms. Your exam will be graded within 72 hours of receipt. On successful completion of the post test (70% or higher), a "Certificate of Completion" will be mailed to the address provided.

COURSE EXAMINATION

1. A timed running event is considered a:
 - a. proportion-based protocol.
 - b. stress-protocol.
 - c. performance-based protocol.
 - d. stress-based program
2. High risk profiles change with:
 - a. age.
 - b. weight
 - c. diet.
 - d. workload.
3. As careers progress, however, our effectiveness shifts from relying on peak physical capabilities to:
 - a. knowledge.
 - b. more refined skills and efficient operations.
 - c. the effectiveness of others.
 - d. none of the above
4. According to the course, the number one cause of line of duty deaths among firefighters is:
 - a. blunt trauma.
 - b. crushing.
 - c. burns.
 - d. heart attacks.
5. Measuring an individual's work output over a period of time through a controlled exercise modality is known as:
 - a. cardiovascular fitness.
 - b. cardiovascular health.
 - c. both a. and b.
 - d. neither a. or b.
6. Weight lifting is an example of:
 - a. cardiovascular fitness.
 - b. maximal power measurement.
 - c. an increasing factor.
 - d. strength dissection.
7. The body's O₂ use is measured in:
 - a. milliliters of O₂ per kilogram of body weight per second.
 - b. milliliters of O₂ per kilogram of body weight per minute.
 - c. millimeters of O₂ per kilogram of body weight per minute.
 - d. millimeters of O₂ per kilogram of body weight per second.
8. The consensus among physicians and exercise physiologists is that firefighters need to be able to use:
 - a. 42 to 44 ml/O₂/kg/min.
 - b. 44 to 46 ml/O₂/kg/min.
 - c. 40 to 42 ml/O₂/kg/min.
 - d. 46 to 48 ml/O₂/kg/min.
9. The cardiovascular system is the
 - a. heart.
 - b. lungs
 - c. vascular network.
 - d. all of the above.
10. Poor cardiovascular health can result from:
 - a. heredity.
 - b. lifestyle choices.
 - c. both a. and b.
 - d. neither a. or b.
11. An examination of the bones, muscle, and connecting tissue is an:
 - a. endoscopic exam
 - b. anterior exam.
 - c. orthopedic exam.
 - d. allusion exam.
12. Your target heart rate during exercise should be what percent of your maximum heart rate?
 - a. 50% - 60% .
 - b. 40% - 50 %.
 - c. 60% - 70%.
 - d. none of the above

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PROGRAM COMPLETION INFORMATION

If you wish to purchase and complete this activity traditionally (mail or fax) rather than Online, you must provide the information requested below. Please be sure to select your answers carefully and complete the evaluation information. To receive credit, you must answer at least six of the eight questions correctly.

Complete online at: www.FireEngineeringUniversity.com

PERSONAL CERTIFICATION INFORMATION:

Last Name (PLEASE PRINT CLEARLY OR TYPE)

First Name

Profession/Credentials License Number

Street Address

Suite or Apartment Number

City/State Zip Code

Daytime Telephone Number with Area Code

Fax Number with Area Code

E-mail Address

TRADITIONAL COMPLETION INFORMATION:

Mail or fax completed answer sheet to
Fire Engineering University, Attn: Carroll Hull,
1421 S. Sheridan Road, Tulsa OK 74112
Fax: (918) 831-9804

PAYMENT & CREDIT INFORMATION

Examination Fee: \$25.00 Credit Hours: 4

Should you have additional questions, please contact Pete Prochilo (973) 251-5053 (Mon-Fri 9:00 am-5:00 pm EST).

- I have enclosed a check or money order.
- I am using a credit card.

My Credit Card information is provided below.

- American Express Visa MC Discover

Please provide the following (please print clearly):

Exact Name on Credit Card

Credit Card # Expiration Date

Signature

ANSWER FORM

Please check the correct box for each question below.

- | | |
|---|---|
| 1. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 11. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D |
| 2. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 12. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D |
| 3. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 13. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D |
| 4. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 14. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D |
| 5. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 15. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D |
| 6. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 16. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D |
| 7. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 17. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D |
| 8. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 18. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D |
| 9. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 19. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D |
| 10. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D | 20. <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D |

COURSE EVALUATION

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 1.

- | | | | | | |
|--|-------|---|---|-----|----|
| 1. To what extent were the course objectives accomplished overall? | 5 | 4 | 3 | 2 | 1 |
| 2. Please rate your personal mastery of the course objectives. | 5 | 4 | 3 | 2 | 1 |
| 3. How would you rate the objectives and educational methods? | 5 | 4 | 3 | 2 | 1 |
| 4. How do you rate the author's grasp of the topic? | 5 | 4 | 3 | 2 | 1 |
| 5. Please rate the instructor's effectiveness. | 5 | 4 | 3 | 2 | 1 |
| 6. Was the overall administration of the course effective? | 5 | 4 | 3 | 2 | 1 |
| 7. Do you feel that the references were adequate? | | | | Yes | No |
| 8. Would you participate in a similar program on a different topic? | | | | Yes | No |
| 9. If any of the continuing education questions were unclear or ambiguous, please list them. | _____ | | | | |

10. Was there any subject matter you found confusing? Please describe.

11. What additional continuing education topics would you like to see?

PLEASE PHOTOCOPY ANSWER SHEET FOR ADDITIONAL PARTICIPANTS.

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COURSE EVALUATION and PARTICIPANT FEEDBACK
We encourage participant feedback pertaining to all courses. Please be sure to complete the survey included with the course. Please e-mail all questions to: Pete Prochilo, peterp@penwell.com.

INSTRUCTIONS
All questions should have only one answer. Grading of this examination is done manually. Participants will receive confirmation of passing by receipt of a verification form.

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COURSE CREDITS/COST
All participants scoring at least 70% on the examination will receive a verification form verifying 4 CE credits. Participants are urged to contact their state or local authority for continuing education requirements.

RECORD KEEPING
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