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AMERICAN COLLEGE of SPORTS MEDICINE
LEADING THE WAY

ACSM CERTIFIED

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ACSM CERTIFIED GROUP EXERCISE INSTRUCTOR℠

LEADING THE WAY FOR GEIs

Grace DeSimone, BA, CPT, GEI

The American College of Sports Medicine (ACSM) has developed a new certification for health and fitness professionals who teach group exercise classes–ACSM Certified Group Exercise Instructor℠ (GEI). When many of us hear the term "group exercise," our thoughts turn to visions of bodies moving in synchronized step to the beat of loud pulsating music. Many of today's group exercise classes still reflect this style, once called "aerobic dance," but group exercise class instruction has become more inclusive and less exclusive. Today's GEIs are teaching boot camps, walking programs, outdoor programs, suspension training, cycling, strength training, muscle conditioning, and rhythmically-based exercise. Qualified GEIs possess versatility and the demand for qualified instructors is high. Hybrid professionals (personal trainers who also serve as GEIs) are becoming more and more prevalent. Once the need was identified, a GEI committee was created in 2009 by ACSM's Committee on Certification and Registry Boards (CCRB). These experts spent countless hours creating a Job Task Analysis (JTA), which helps identify and determine what knowledge and which skills are most critical and necessary for a GEI to perform their job(s) proficiently and competently. The GEI JTA was developed over the course of a year and was written carefully to elicit responses from GEIs that function both as independent contractors and employees since their job functions and responsibilities differ respectively. The JTA also will serve as the Exam Content Outline for certification preparation.

ACSM's GEI certification endeavors to lead the way for more professionals to teach more individuals in a group exercise class setting. Leading groups in organized physical activity is a unique skill that requires leadership and presentation skills. Knowledge and skills (KSs) considered "critical" to function as a proficient and competent GEI appear in one of four (4) "Performance Domains." The performance domain for GEI receiving the highest criticality rating was "Leadership" (at 55% compared to all other domains).

Eligibility requirements to take the GEI certification examination include a high school diploma or equivalent and a current adult CPR certification (with practical skills component). Candidates must be 18 years of age or older. There are 100 examination questions. The percentage of questions in each performance domain is:

- Domain I: Participant and Program Assessment–10%
- Domain II: Class Design–25%
- Domain III: Leadership and Instruction–55%
- Domain IV: Legal and Professional Responsibilities–10%

A total of 65 candidates took the examination in 2010 and approximately 65 more are expected to take it in 2011. *ACSM's Resources for the Group Exercise Instructor*[1] is now available (however not a requirement) along with a webinar series designed to assist candidates preparing for the examination.

I would like to acknowledge the GEI committee members (past and present) for pioneering the JTAs, authoring and reviewing *ACSM's Resources for the Group Exercise Instructor* chapters and for their belief and support in raising the bar for our GEI profession: Ken Alan, B.S.; Teri L. Bladen, M.S.; Sabrina Fairchild, M.A., and Leslie Stenger, Ph.D.

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ONLINE TIPS AND TOOLS FOR EXERCISE PROFESSIONALS

By Peter Ronai, M.S., FACSM, RCEP, CES, PD, CSCS-D

Exercise practitioners interested in obtaining current health and medical science information have a number of reputable and useful electronic resources and tools available to them.

Understanding the steps involved with conducting physical examinations and assessments and identifying the context of their findings and results are important skills for clinical exercise physiologists and clinical exercise specialists. Both designing safe and effective exercise interventions and making appropriate exercise modifications are facilitated by having this understanding.

The University of Florida College of Medicine's Harrell Professional Development and Assessment Center and the Office of Medical Informatics developed the Online Physical Exam Teaching Assistant (OPETA) to help provide medical students with supplementary information on conducting physical examinations. This article will describe briefly this learning tool and provide information on how to access it.

The University of Florida OPETA page is a useful resource for professionals who must perform physiologic systems exams on their patients. The developers of this service state that, "This program is designed as an aid to demonstrate acceptable technique expected of the first year medical student. This is only a foundation and may not fully encompass the needs of your patients."[2] Medical students who use this tool also are urged to refer to their textbooks and a basic clinical skills Web site developed by the school for better explanations of the purpose and various findings.[2]

Viewers can access this page at:

http://medinfo.ufl.edu/other/opeta/index.html.

The University of Florida has developed a library of narrated instructional videos on conducting specific types of physical examinations. Viewers can select the type of evaluation they wish to view. Evaluations and tests are organized into tabs by anatomical regions and, in some cases, by physiologic function(s).

Viewer tabs include:

- Vital Signs
- Musculoskeletal Exam Chest Exam
- Cardiovascular Exam
- HEENT (Head, Eyes, Ears, Neck, and Throat)
- Abdomen Exam
- Neurologic Exam
- Eye Exam

Narrated, instructional videos explain and demonstrate the key steps and skills necessary for conducting effective physical examinations. The content includes explanations of: the theoretical and scientific background behind each test, the purpose of each examination, and tips on proper patient positioning, preparation, visualization, palpation, and auscultation. Viewers are provided examples of normal and common abnormal findings and signs to look for. Some abnormal signs are related to potential physical problems related to the system being evaluated. Although useful, these narrated videos are not meant to provide medical advice, diagnoses, or opinions. Viewers should refer clients with suspected medical conditions to their physician and/or health care provider for consultation. This page is an educational tool. This tool was successfully reviewed by the Medical Education Portal, MedEdPORTAL (MedEdPORTAL Publication Number: 203 on 10/28/05), which is a service of the Association of American Medical Colleges (AAMC; https://www.aamc.org). According to the MedEdPORTAL Web site (https://www.mededportal.org), "MedEdPORTAL is a free peer-reviewed publication service and repository for medical and oral health teaching materials, assessment tools, and faculty development resources."[1]

The AAMC serves and leads the academic medicine community to improve the health of all. Its initiatives include:

- Medical Education
- Medical Research
- Patient Care

The content provided within this Web site is commensurate with knowledge required of many clinical exercise physiologists and exercise specialists. Exercise professionals can better understand results of pertinent clinical evaluations and assessments provided to them by their client's physicians and henceforth design safe, individualized exercise programs within this context.

About the Author

Peter Ronai, M.S., FACSM, RCEP, CES, PD, CSCS-D, is a clinical assistant professor in the Exercise Science Department at Sacred Heart University in Fairfield Connecticut. He is a clinical exercise physiologist and previously was manager of Community Health at the Ahlbin Rehabilitation Centers of Bridgeport Hospital in Connecticut and an adjunct professor in the Exercise Science Department at Southern Connecticut State University. He is a Fellow of the American College of Sports Medicine (ACSM). He is past-president of the New England Chapter of ACSM (NEACSM), past member of the ACSM Registered Clinical Exercise Physiologist (RCEP) Practice Board, Continuing Professional Education Committee, and current member of the ACSM Publications sub-committee. He is also the Special Populations column editor for the National Strength and Conditioning Association's Strength and Conditioning Journal (SCJ) and a co-editor of *ACSM's Certified News.*

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PART 1: AEROBIC EXERCISE DURING PREGNANCY

By Linda May, Ph.D.

While the benefits of aerobic exercise are widely known, many women are unsure if exercising while pregnant is feasible. Knowledge of how exercise affects mother and child has increased greatly through the inquiries of investigators. Through their efforts, researchers have determined the alterations normally associated with aerobic exercise are not detrimental to pregnancy outcomes. Having answered the question of if aerobic exercise during pregnancy is safe, the next step for academia has been to establish guidelines for physical activity during gestation.

Since 1985, the American Congress of Obstetricians and Gynecologists (ACOG) have updated aerobic exercise and pregnancy guidelines. All women should consult their physician to verify they are able to participate in aerobic exercise while pregnant. Prior to initiating an exercise program, pregnant clients should first complete a brief screening questionnaire, such as the PARmed-X, which is a free download (http://www.csep.ca/forms.asp). This documentation enables you to determine your client's health status. All exercise professionals should know the absolute contraindications to exercise during pregnancy, listed in ACOG Committee Opinion #267.[1] Additionally, exercise trainers need to know relative contraindications to enable them to discuss benefits to risks with their clients, and determine how exercise may influence pregnancy outcomes.[1] Lastly, all fitness instructors should know when to terminate exercise immediately (*i.e.,* vaginal bleeding, difficulty breathing, dizziness, headache, chest pain, calf pain/swelling, preterm labor, amniotic fluid leakage).[1] Maintain a file for each pregnant client that includes 1) signed physician approval note, 2) completed screening questionnaire, 3) exercise program description, and 4) exercise progress notes.

Acute Response to Aerobic Exercise While Pregnant

It is important to understand the acute physiological responses to exercise when pregnant. Although utero-placental blood flow decreases slightly, the increased oxygen transport capacity[3, 15] with increased plasma and red cell volume maintains adequate nutrient and oxygen to the developing fetus.[3, 4, 10] Additionally, the hormone changes associated with acute exercise are not associated with fetal demise, premature labor, or adverse pregnancy outcomes.[5] Although exercise alters maternal blood glucose levels, glucose is maintained to the developing fetus.[6] The normal hyperthermic response of exercise is not teratogenic (leading to birth defects) since the mother has a lower body temperature, increased skin blood flow, and a lower sweating threshold to improve heat dissipation away from the fetus.[5] A woman's altered center of gravity and increased joint laxity is not associated with falls, or injuries during exercise.[5] Lastly, stresses from high impact pounding as in aerobics or running, does not cause adverse pregnancy outcomes (*i.e.*, rupture membranes, preterm labor, fetal injury/demise, spontaneous abortion, malformations, placental complications, etc.).[5, 7] Therefore, acute physiological responses from aerobic exercise are safe while pregnant.

Benefits of Regular Aerobic Exercise throughout Pregnancy

Current studies demonstrate regular participation in aerobic activity throughout gestation is associated with improved outcomes for mother and baby. The mother enjoys improved mood/self esteem, appropriate weight gain (decreased fat deposition), improved cardiovascular system, improved muscle tone, improved posture, and decreased aches of pregnancy.[1] Further, her continual activity can improve her "performance" during labor and delivery. Studies show that regular aerobic exercise increased the likelihood of delivery close to the estimated due date, decreased labor and delivery time, and quicker recovery.[5] There are also "training effects" for the baby. For example, regular maternal exercise at or above ACOG minimum recommendations leads to improved fetal cardiac autonomic control, similar to the lower resting heart rate seen in an adult exercise trained response.[13] This improved control of the fetal heart persists after birth.[14] Studies found offspring exposed to maternal exercise in utero were leaner, with improved academic and athletic performance as children and young adults compared to non-exposed counterparts.[11] These findings must be interpreted with caution since outcomes can differ based on frequency, intensity, time, and type of exercise.

Aerobic Exercise Guidelines

Whether women are exercise veterans or just getting started, the same questions are asked: How often, how hard, and how long can one exercise during pregnancy? What aerobic exercises are safe during pregnancy? Women are often likely to believe the outdated claims or myths from magazines, family, and friends instead of their physicians or exercise professional.[8] Due to the breadth of research in this area, current federal, ACOG, and American College of Sports Medicine (ACSM) guidelines recommend pregnant women to participate in 30 minutes or more of moderate to vigorous aerobic exercise, 3 or more days of the week, in the absence of pregnancy complications. Women who were previously active can continue an aerobic exercise regimen, even above these minimum recommendations (*i.e.*, >30 min, 7 days per week, moderate to vigorous activity). However, a large retrospective cohort study of Danish women finds first trimester aerobic exercise of ≥75 minutes per week could be associated with an increased risk of miscarriage.[12] The ideal exercise time range during the first trimester of pregnancy seemed to be 45 to 74 minutes per week; as a retrospective study, however, the authors cautioned that recall bias may have influenced these values. In the second and third trimesters there were no associations with miscarriages and amount of exercise.[12] Additionally, one study suggests too much exercise (>5 times per week), similar to not enough (≤2 times per week), may be associated with an increased likelihood of delivering a small-for-gestational age baby.[2] Though these findings have not been found in other studies, small-for-gestational age is considered a risk factor for obesity and cardiovascular disease later in life, thus the safest

frequency of an exercise program should be 3 to 5 times per week.[2] Although competitive and highly trained athletes might safely train harder than most women during pregnancy, for the average fit individuals a rating of perceived exertion (RPE) of 12 to 14 (moderate) is suggested, but this may decrease in late pregnancy. For women who were sedentary prior to conceiving, it is suggested they begin with 5 minutes of comfortable activity (*i.e.*, utilize the talk test, ≤12 RPE) for 3 days of the week, and add 5 minutes every week if she can talk comfortably while exercising and has no pain or symptoms. Once she reaches the minimum of 30 minute sessions, then an additional day can be added, if desired. Always precede and succeed the aerobic session with a brief warm-up/cool-down session (*i.e.*, light stretching, slow walk). Therefore, all pregnant women can exercise most days of the week, at moderate to vigorous intensity, and aim to achieve at least 30 minutes per session.

Once appropriate frequency, intensity, and time are established, the mode(s) of aerobic exercise is chosen. Some exercises should be avoided while others only need modifications. As the pregnant abdomen enlarges, it is advisable to avoid certain aerobic sports (*i.e.*, ice hockey, ball sports, court sports, gymnastics, horseback riding, water skiing, martial arts, etc.); though there are no findings of adverse pregnancy outcomes[5] and the risk of abdominal injury is very low.[9] For modifications, ACOG recommends snow skiing on safe slopes only. While outdoor skiing can be switched to indoor cross country skiing. Other activities such as road cycling should be modified to stationary cycling or spinning.

Typically, exercise veterans can continue their regular aerobic routine, as long as there current aerobic activity is not one that may cause fetal trauma. For beginners, choose a low risk, comfortable, enjoyable activity. Low risk aerobic activities include swimming, walking, jogging, spinning/cycling, aerobics classes, most aerobic equipment (*i.e.*, stair climber, elliptical, rowing). Avoid activities that may decrease maternal circulation by compressing the inferior vena cava (*i.e.*, Crossrobics). Swimming is shown to be the safest aerobic activity throughout pregnancy, due to the low impact nature and improved thermoregulation.[12] The most common aerobic activity during pregnancy is walking, as it involves little expense and can be done anywhere, at varying intensities. Late pregnancy hormonal changes causing joint laxity may necessitate further modification of aerobic activity. Allow your pregnant clientele to choose one or more safe aerobic exercises that she feels comfortable doing and enjoys.

As the pregnant body continues to change, other modifications must be considered to ensure a woman's participation in exercise is safe and comfortable. In order to maintain a heat gradient away from the fetus, women must exercise in an environment that is comfortable, and must maintain fluid satiety. Women should not wear any restrictive clothing. With the augmentation of breast tissue and the nature of aerobic activity, women should wear a supportive bra and not a sports bra. To support their growing belly, women may require a belly band or sling during their exercise activity. Ideally, women should feel comfortable while exercising.

Summary

Most importantly, exercise during a healthy, uncomplicated pregnancy is safe, regardless of fitness level. Before beginning an exercise program for any pregnant client, keep files containing obstetrician permission, completed screening questionnaire, exercise program description, and exercise progress notes. Make sure you and your client know when to terminate an exercise session. Participation in consistent, aerobic exercise throughout the pregnancy is beneficial for mother and baby. These benefits can motivate women to maintain their program throughout gestation. Additionally, make sure your client is comfortable and hydrated during exercises. Also ensure the frequency, intensity, time, and type of exercise is appropriate while allowing maintenance/gains in fitness. Ultimately, following a regular aerobic exercise program will provide benefits during and even after the pregnancy.

About the Author

Linda May, Ph.D., an assistant professor at Kansas City University of Medicine and Biosciences, teaches histology, gross anatomy, and physiology to graduate and medical students. Her research looks at effects of exercise during pregnancy on fetal/neonatal heart and autonomic nervous system development. Away from work, she enjoys time with her family, exercising, gardening, cooking, and baseball.

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HIGH-INTENSITY EXERCISE AND IMMUNE FUNCTION IN ELITE ATHLETES

BY ERIC CHRISTENSEN, B.S., NREMT-B

Regular, moderate intensity exercise may improve immune function and reduce susceptibility to infections such as the common cold.[9] Specifically, regular exercise has been shown to reduce the release of stress hormones such as cortisol, which can suppress the immune system when chronically circulating in the blood stream.[9] However, research also has demonstrated a possible link between high intensity exercise and a post-exercise immunosuppressant effect.[13]

A review by Gleeson found that acute bouts of exercise lead to a temporary depression effect of various aspects of the body's immune function lasting 3 to 24 hours after exercise.[3] This period, termed the "open window" phenomenon, may increase the risk of developing upper respiratory tract infections (URI) in athletes.[11] The greatest effect of post-exercise immunosuppression seems to occur following exercise that is continuous in nature at a moderate to high intensity (55% to 75% $\dot{V}O_2$max) for prolonged periods (>1.5 h) without food intake.[3] This type of overtraining is common practice in many elite athletes, which have shown an increased incidence of URIs.[11,13,3,2] This review will evaluate results from several studies of the acute effects of high intensity exercise training and its possible link to increasing the susceptibility of elite athletes to URIs. In addition, the effectiveness of selected nutritional supplements on reducing an athlete's susceptibility to URIs will be examined.

Defending our Bodies

Roughly speaking, the human immune system is comprised of two primary defense mechanisms: innate immunity (nonspecific resistance) and adaptive immunity (specific resistance).[15]

Innate immunity makes up the first line of defense and consists of three levels.[3] The first involves physical barriers such as skin, mucosal secretions, and epithelial linings that work to prevent foreign substances from entering into the body.[3] For example tears from the eyes, urine from the urinary tract, and saliva from the mouth all work to wash away microorganisms before they can invade the body.[15]

For foreign substances that make it past these barriers into the second defense level, chemical barriers such as the pH of many bodily fluids destroy several of these substances on contact.[3] Additionally, chemical mediators such as complement proteins (interferons, interleukins, and lymphokines) bind to foreign substances.[15] Complement proteins are a group of 20 proteins that circulate in the blood stream in an inactive form.[15] When they recognize a foreign substance they attach themselves to it, signaling the final immune response.[15]

The last innate immunity defense against remaining foreign substances consists of phagocytic and cytotoxic cells. Neutrophils, monocytes, lymphocytes, and macrophages comprise the body's phagocytic cells while natural killer (NK) cells are the primary cytotoxic cells.[3] These cells act to destroy foreign particles that have been flagged by complement proteins through phagocytosis.[15] Essentially innate immunity uses the same response to attack foreign particles every time they invade the human body.

Adaptive immunity works on the principles of specificity and memory. These abilities allow the immune system to remember and recognize foreign substances that have previously invaded the body and launch a specific immune response.[15] Adaptive immunity permits a much faster and stronger response from macrophages, neutrophils, and NK cells.[15] Many times this response destroys foreign particles before any symptoms occur, in which case the individual is said to be "immune" to that particular particle.[15] Adaptive immunity is a unique ability only possessed by vertebrates.[15]

URIs present a distinctive challenge for the immune system because of the numerous forms and high degree of variations within that class of infections.

URIs are defined as acute illnesses caused by microbial agents affecting any part of the upper respiratory tract including the bronchi, trachea, larynx, paranasal sinuses, and the nose. Most commonly these infections are caused by viruses such as the rhinovirus, coronavirus, and influenza virus. Transmission of these viruses occurs through droplet, aerosol, or direct hand-to-hand contact with infected secretions. Subsequently, these viruses then pass through the nasal cavity or mucosa of the eyes once the individual touches their face with their hands. As such, URIs most commonly are transmitted between individuals in crowded situations like buses full of traveling athletes. Symptoms of these infections generally occur within 1 to 3 days following infection and most commonly involve sore throat, nasal congestion, sneezing, and possible low-grade fever.[8] The typical duration of illness is approximately 7 to 14 days.[5]

Why Study URIs in Athletes?

URIs are the most common infections in the adult population.[13] Typically, during summer and winter Olympic Games, URIs are the most common medical condition affecting athletes.[14] On average, an adult contracts 2 to 5 URIs every year.[13] Ultimately, this results in approximately 200,000 hospitalizations and 36,000 deaths yearly.[5] Current epidemiological studies have resulted in the hypothesis of a "J-shaped" curve relationship between the amount of exercise performed and the incidence of URI symptoms.[13] The highest incidence of URI symptoms is seen in athletes who perform prolonged duration, high intensity exercise.[13]

Numerous studies have examined the acute and chronic effects of exercise training on immune function. In fact, between the years of 1993 to 2008 approximately 80% of all scientific literature attempted to uncover the connections.[13,9] Currently, the most frequent arguments revolve around the post-exercise immunosuppression effects of high intensity exercise and whether it directly affects the susceptibly of athletes to URIs. An additional argument involves whether these athletes are truly contracting URIs or rather just experiencing exercise-induced symptoms similar to common URI symptoms. If indeed elite athletes are more susceptible to URIs, then there is means to use some sort of nutritional supplement to counteract this without altering the athlete's train-

ing regime. In the 1990s, vitamin C and carbohydrate supplementation had been thought to be an effective means to reduce the incidence of URIs and studies by Peters *et al.* and Nieman *et al.*, respectively, helped to solidify these results.[12,10] Glutamine supplementation also was thought to aid in the reduction of URI incidence as glutamine is an important fuel for lymphocytes and macrophages.[11] However, to be explained later, a study by Krzywkowski *et al.* found that this may not be the case.[4] Therefore, further explanation of more current research is necessary.

When is it Too Much Exercise?

According to previous survey-based studies, elite athletes experience a much higher degree of sore throats and flu-like symptoms when compared to the general population.[3] This may be because elite athletes face numerous immune challenges due to sport participation alone. For example, athletes confront environmental, physiological, and psychological stresses. In addition, elite athletes are often sleep-deprived and follow poor dietary practices throughout the competitive season, all of which tend to depress the immune system.[3] Likewise, through increased ventilations, skin abrasions, and contact with large crowds and travel, elite athletes also have increased exposure to pathogens.[3] With this increased susceptibility to infection, more pressure is placed on the immune system to prevent infection.

A study by Spence *et al.* examined the incidence and etiology of URIs in athletes during five months of the competitive season.[14] Thirty-two elite male and female triathletes and cyclists, 31 male and female recreationally competitive triathletes and cyclists, and 20 male and female controls were included in the study. During the study, subjects were required to maintain their normal training regime. In total, 28 subjects reported URI symptoms with 7 subjects reporting multiple episodes. Elite athletes made up 57% of the cases and the highest incidence of URI symptoms occurred during the heaviest training periods. Symptoms generally lasted approximately one week.[14] This further validates the argument that elite athletes are more susceptible to URIs, especially during their heaviest training periods.

Exercise-induced immunosuppression appears to affect only the innate immunity system, while leaving adaptive immunity completely intact.[11,13] During high-intensity, long-duration exercise lymphocyte concentrations increase, but fall below pre-exercise levels following cessation of exercise.[11] Additionally, NK cell cytotoxic activity is inhibited for at least six hours post-exercise.[11,13] Immunoglobulin A (IgA) is an antibody secreted in the mucous membranes designed to bind to foreign particles and prevent their entry into the body.[5] IgA production also is reduced following intense, long duration exercise.[11,5] Repeated exercise bouts may result in cumulative reductions putting the athlete at greater risk.[13] Combined, this poses a serious threat to the body's immune system.

Excessive exercise can induce an "overtraining" syndrome effect, in which the individual becomes chronically fatigued and performance progressively diminishes. This syndrome results in elevated concentrations of catecholamines and glucocorticoids.[13] Elevated levels of these hormones suppress the body's cell-mediated immune response.[13] As such, the excessive training regime of many elite athletes may make them more susceptible to URIs. The greatest effect of acute post-exercise immunosuppression has been observed following exercise at intensities equal to 55% to 75% of $\dot{V}O_2$max for prolonged durations of >1.5 hours without food intake.[3] In fact, it has been reported that in the weeks following an ultra-endurance running event, athletes are 100% to 500% more likely to contract an infection than the general population.[3]

Approximately 30% to 50% of athletes who participate in ultramarathon events have consistently reported symptoms of URIs.[13] Athletes with faster running times and higher training loads (>65 km·wk^{-1}) are at the greatest risk for developing symptoms.[13] Further examined in a review by Martin *et al.*, runners in the upper two quartiles of yearly mileage (>866 miles) were found to be at a significantly higher risk for developing URI symptoms.[5]

However, an important question develops in light of these findings because study results often suggest that symptoms were the result of an infection.[13] However, in the studies included in the Martin *et al.* review, only 30% of all URI cases were directly linked to a specific pathogen.[5] Likewise, in the study of triathletes by Spence *et al.*, only 11 of the 37 illness episodes (~30%) were linked to viral or bacterial infections.[14] Thus, it has been suggested that these symptoms are instead the result of exposure to allergens and pollution since common URI symptoms like sore throat and coughing also are connected to allergen/pollution exposure.[13,5] It may be the case that many elite athletes are not actually contracting URIs following severe exercise. Although, it should be considered when training elite athletes that current research still indicates an immunosuppression effect with excessive exercise.

Nutritional Supplements

Vitamin C supplementation, with regards to enhancing immune function, has been a topic of controversy for many years. A study by Peters *et al.* examined the effects of daily vitamin C supplementation in ultramarathoners on the development of post-race URIs.[12] A total of 92 runners were recruited and divided randomly into placebo and experimental groups. The experimental group consumed daily doses of 600 mg of vitamin C, while the placebo group consumed identical looking and tasting placebos consisting of citric acid. Following the completion of an ultramarathon by all subjects, the development of URI symptoms were monitored for 14 days. In the placebo group, 68% of subjects reported the development of URI symptoms following the race.[12] This finding was significantly higher than the experimental group ($P < 0.01$), which reported only 33% of subjects experience URI symptoms.[12] These results represent a possible link between vitamin C supplementation and a reduction in the incidence of URIs in elite athletes.

A more current study by Davison *et al.* examined the effects of antioxidant supplementation on preventing the immunosuppression seen with prolonged duration exercise and blunting the release of cortisol.[1] One of the major problems with the release of cortisol is its effect on increasing neutrophilia. Neutrophilia is when immature neutrophils are released into the blood stream. These immature neutrophils have a lower functional capacity. As such a depression in neutrophil function may lead to subsequent depressions in immune function. Twenty recreationally active males were randomly assigned to placebo and antioxidant supplement groups, which involved consumption of 1,000 mg of vitamin C and 400 IU of vitamin E for four weeks.[1] As a reference point, it is generally recommended that the average adult female and male consume 75 and 90 mg/day of vitamin C, respectively.[6] The supplements consumed during this trial are well over 10 times those values. The subjects completed a 2.5 hour cycling bout at an intensity equal to 60% of $\dot{V}O_2$max. The results of this study found that supplementing with high doses of vitamin C inhibited blood cortisol levels. This however did not lead to a reduction in exercise-induced neutrophilia.[1] Therefore, the effectiveness of vitamin C supplementation in preventing immunosup-

High-Intensity *(continued on page 14)*

ISSUES FOR CLINICAL EXERCISE PHYSIOLOGISTS:

THE 6-MINUTE WALK TEST IN PULMONARY REHABILITATION

David E. Verrill, MS, RCEP, CES, FAACVPR

The 6-minute walk test (6MWT) has gained widespread use in cardiopulmonary rehabilitation programs as one measure of fitness. This test assists the clinical exercise physiologist (CEP) in assessing: 1) submaximal functional capability, 2) need for supplemental oxygen or oxygen titration, 3) exercise prescription from peak heart rate, rating of perceived dyspnea/exertion, and estimated METS, 4) physiological responses to exertion, and 5) the physiological response to medical interventions. While this test is used routinely in cardiac rehabilitation programs to assess those with heart disease[11] or congestive heart failure,[3, 10] this article will focus on testing patients of pulmonary rehabilitation (PR) programs.[1, 4, 13, 20] This article is not intended to describe how to fully administer the 6MWT as there are guidelines available for this.[1, 20] Rather, areas of this test that remain ambiguous to some practitioners will be discussed to help provide guidance in these areas.

The definitive source of practical guidelines for the 6MWT in PR is the *American Thoracic Society (ATS) Statement: Guidelines for the Six-Minute Walk Test."*[1] This document has helped guide PR practitioners in proper test administration since 2002. Other forms of clinical exercise testing include stair climbing, the incremental shuttle-walk test,[19] the graded exercise test (with or without radionuclide imaging), and the cardiopulmonary exercise test with metabolic analysis. While each of these tests has advantages and disadvantages, the 6MWT is the most commonly used test today in PR programs, as it is one of the simplest to administer and is both reliable and valid in pulmonary populations.[1, 13, 20]

A number of issues have arisen over the years with regard to proper administration of the 6MWT in pulmonary populations. There are numerous sources of variability that must be considered that may either increase (Table 1) or decrease (Table 2) 6MWT performance. This article will address some of these issues with questions that CEPs (and others) have raised to help provide insight in administration of this popular test.

1. If we have an indoor or outdoor oval track, can we perform the 6MWT on the track?

The ATS Guidelines state: "*The 6MWT should be performed indoors, along a long, flat, straight enclosed corridor with a hard surface that is seldom traveled. If the weather is comfortable, the test may be performed outdoors. The walking course must be 30 meters in length. A 100-foot hallway is, therefore, required*"[1] (page 113). One reason for this stipulation is that many facilities lack an indoor/outdoor track or an extended hallway, particularly pulmonologist practices where the 6MWT is routinely performed to assess pulmonary function and oxygen titration issues. Thus, a shorter hallway is often the only area to perform this test.

While there remains considerable variability in 6MWT performance across different clinical settings due to test location,[6, 17, 18] this source of variability can be controlled. It would seem logical that if an oval track is available, the 6MWT can be performed on the track by the CEP. This is recommended for a number of reasons: 1) 6MWT performance is improved by 92.2 feet in patients who walk around an oval track vs. walking on a straight (out and back) course,[17] 2) an oval track allows for continuous walking, whereas a 100-foot indoor hallway necessitates that the patient make turns at both ends around cones which may decrease the number of feet walked and increase fatigue, 3) many pulmonary patients are quite frail and making turns during a walking test is difficult due to balance issues, and 4) it is hard to maneuver a rollator (if used) in a hallway around turns and corners.

The ideal 6MWT locations may very well be oval indoor (climate controlled) or outdoor tracks or extended straight hallways. Unfortunately, the ATS cannot recommend these locations, as many facilities do not have such amenities. Since 6MWT performance varies by the location of the test,[17] the CEP should administer all tests in the same location that affords the best opportunity for peak functional performance. Future 6MWT investigations should examine the benefits of oval or continuous track walking for the pulmonary patient and, if favorable, incorporate the option of using an oval or extended track into future updated guidelines.

2. Do words of encouragement matter during the 6MWT?

Words of encouragement can increase the distance walked during the 6MWT.[9] Thus, the CEP should give standardized words of encour-

Table 1. Factors That May Increase 6MWT Performance*

1. Taller height (longer legs)
2. Male sex
3. Walking on an oval indoor track
4. Walking on an extended straight hallway (< 100 feet)
5. High motivation
6. Words of encouragement, coaching effects, or positive gestures
7. Having performed the test previously (*e.g.*, learning effect)
8. Medication administration immediately prior to the test (*e.g.*, pulmonary inhalers)
9. Oxygen supplementation in patients with exercise-induced hypoxemia
10. Exercise training

*Adapted from references1, 4, 11, 13, 20

Table 2. Factors That May Decrease 6MWT Performance*

1. Shorter height (shorter legs)
2. Older age
3. Female sex
4. A shorter distance testing area (more turns)
5. Walking longer distances (*e.g.*, 6-minute vs. 12-minute test)
6. Having chronic pulmonary disease (*e.g.*, COPD, asthma, cystic fibrosis, interstitial lung disease)
7. Having musculoskeletal disorders (*e.g.*, arthritis, joint injury, osteoporosis)
8. Having cardiovascular disease (*e.g.*, congestive heart failure, stroke, angina)
9. Higher ambient temperature, humidity, pollen count and/or air pollution
10. Walking on a self-paced treadmill for testing
11. Number of rest periods and time spent during rest periods

*Adapted from references1, 4, 11, 13, 20

agement (in even tones) in accordance with the ATS guidelines:[1]

1. After the 1st minute: *"You are doing well. You have 5 minutes to go."*
2. With 4 minutes remaining: *"Keep up the good work. You have 4 minutes to go."*
3. With 3 minutes remaining: *"You are doing well. You are halfway done."*
4. With 2 minutes remaining: *"Keep up the good work. You only have 2 minutes left."*
5. With 1 minute remaining: *"You are doing well. You have only 1 minute to go."*
6. At 15 seconds from completion: *"In a moment I'm going to tell you to stop. When I do, just stop right where you are and I will come to you."*

With standardized words of encouragement, there is less chance of some patients walking further distances due to enthusiastic words or gestures from the tester.

3. Can we perform the 6MWT for our PR patients on a treadmill?

While treadmill utilization would seem to be a great solution for performing a 6MWT in facilities with limited space requirements due to the availability of continuous monitoring, standardized speeds and a climate controlled temperature, it is currently not advisable.[1] Timed treadmill distance testing, where the patient is free to alter the speed of the treadmill, has been shown to result in shorter distances walked due to the difficulty in pacing accurately during walking.[2, 21] Moreover, pulmonary patients likely are unable to pace themselves properly on a treadmill as it involves a different skill set, which may be totally unfamiliar to the patient.[1,21] Finally, deconditioned patients may not be able to walk even the lowest speed on the treadmill. Thus, performing the 6MWT on a treadmill is discouraged at this time.

4. Should I walk with the patient to monitor his/her SpO_2 or to pull their oxygen tank?

While it is tempting to walk with the patient to pull their oxygen tank or to monitor their SpO_2 frequently, this is discouraged. Any interaction between the CEP and the patient during the test may affect test results. If exertional hypoxemia is a concern, light-weight pulse oximeters are available that can be worn on the wrist or held in place around the waist. Units also are available that transmit SpO_2 and heart rate data to a base unit for continuous monitoring. Be aware that motion artifact and patient contact affect even the best oximeters and can prevent accurate readings taken during the walk.

5. Should we have the patient perform a "warm-up" period prior to the test?

A warm-up period should not be performed before the 6MWT.[1] The patient should sit quietly in a chair for at least 10 minutes in order to accurately assess resting heart rate, blood pressure, and SpO_2 levels.

6. Should we perform a practice test or conduct more than one 6MWT on the same day or over different days and take the best result?

The ATS suggests that a practice test is not needed in most clinical settings, but may be considered.[1] Considering that 6MWT distance is only slightly improved (0%-17%) when performed a day apart,[13, 14, 16, 25] it is likely that the effort involved to re-test the patient, particularly in a cost-effective and time-restrained PR environment, is unnecessary. Valid test results may be obtained if the patient performs just one 6MWT during their initial visit. If a practice 6MWT is performed, the tester should wait at least one hour before the second test and then report the greatest distance walked as the patient's baseline measure. However, waiting an hour between tests may be inconvenient for both the patient and staff due to time spent in the facility. Moreover, the longer a patient stays for their initial testing, the more likely fatigue will play a role which may shorten the walking distance on the second test.

7. If a patient uses oxygen at a rate of 4 liters/minute with nasal cannula (for example) on their initial 6MWT, performs 12-weeks of PR intervention, and subsequently has their oxygen flow reduced to 2 liters/minute with exercise, should I use their entry or current liter flow for their follow-up test?

The ATS states the following:[1]

1. "If a patient is on chronic oxygen therapy, oxygen should be given at their standard rate or as directed by a physician or a protocol." (page 112)
2. "If oxygen supplementation is needed during the walks and serial tests are planned (after an intervention other than oxygen therapy), then during all walks by that patient oxygen should be delivered in the same way with the same flow." (page 115)

If a patient needs to have an increased oxygen liter flow due to worsening lung disease or gas exchange on their follow-up test, the ATS acknowledges this and recommends noting this on the worksheet to help with interpretation of the 6MWT results. If the patient requires *less* oxygen liter flow due to a positive exercise training effect, the above should apply as well. If a patient was using oxygen at PR entry and discontinues supplemental oxygen altogether by physician order, the follow-up test should be performed without oxygen as well.

8. Are 6MWT normative values available for pulmonary patients?

Currently, 6MWT normative data exist for adults aged 20 to 40,[8] healthy adults,[7] and healthy middle-aged and elderly subjects.[12, 22] It is not valid to compare 6MWT results of PR participants to normative data of apparently healthy subjects. However, between 2001 and 2008, 6MWT data was obtained from 1,971 men and 1,652 women from 19 North Carolina PR programs at PR entry and following 12 weeks of PR participation.[15] Mean 6MW scores were determined for men and women in four age categories: ≤ 50, 51-60, 61-70, and ≥ 71 years. Normative values and regression equations have been developed for both men and women from this cohort of patients.[15, 24] While these equations have not yet been validated for validity and reliability (in progress), we have found these equations to be useful in North Carolina PR programs to help show both the physician and patient at what percentage they are of their age predicted 6MWT distance.

Conclusion

The 6MWT is a valuable testing tool to help assess entry physical status and monitor progress throughout PR participation for outcomes assessment.[23] This test also helps the CEP in assessing the BODE Index,[5]

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COACHING NEWS:
ORGANIZE YOUR MIND TO ADDRESS THE EPIDEMIC OF DISTRACTION

By Margaret Moore (Coach Meg), M.B.A.

THE HUMAN RACE HAS REACHED A POINT OF INFORMATION OVERLOAD, OR AT LEAST A POINT WHERE PEOPLE OFTEN FEEL SO OVERWHELMED BY DAILY DEMANDS THAT THEY RISK THEIR LIVES WHILE DRIVING FOR ONE MORE TEXT OR PHONE CALL. SOME PEOPLE CONSIDER THE DISTRACTION EPIDEMIC THE PSYCHOLOGICAL EQUIVALENT OF THE OBESITY EPIDEMIC. FITNESS PROFESSIONALS ARE NOT IMMUNE TO OVERLOAD, PERHAPS AT TIMES YOU FEEL DISTRACTED, STRESSED, OR DISORGANIZED. YOU MAY FIND IT HARD TO BRING YOUR FULL ATTENTION TO CLIENT AFTER CLIENT, OR SHIFT YOUR WHOLE, UNDIVIDED ATTENTION TO FAMILY AND FRIENDS WHEN YOU ARE NOT WORKING.

In the new book *Organize Your Mind, Organize Your Life,* to be launched January 2012 by Harvard Health Books and Harlequin, I team up with Harvard psychiatrist and Attention Deficit Hyperactivity Disorder (ADHD) expert Paul Hammerness, M.D., to describe six rules of order for using "top down" organization, or brain science, to move from a state of frenzy to get to the big picture around the small and large domains of life.[1] While you may sometimes be disorganized, your brain is not. The brain is a jewel of organization and structure, of different components working harmoniously together.

Other models of "getting organized" begin with organizing your priorities, time, and surroundings—your desk, your household, rather than organizing your mind. The Organize Your Mind rules relate to brain or "cognitive" abilities that are embedded features in our brains, waiting to be switched on. Here's a brief preview of the six rules and how you can use them to improve your energy, creativity, and productivity.

Rule 1: Tame the Frenzy. Before you can get focused, you need to get into control, or at least have a handle on your emotional frenzy, various negative thoughts and emotions that are buzzing around you. This frenzy impairs and overwhelms the prefrontal cortex, the brain's CEO region, so that you can't "think straight." While an optimal dose of stress is a valuable state for stretching you to learn, too much negativity rapidly depletes your brain. Recovery is stress's best friend, allowing you to rest and recharge so that you are ready to resume an intense and productive focus. Exercise your body, do a mindfulness practice, or choose the slow lane from time to time. These activities will help tame your frenzy, allow space for productive thinking and reflecting so that you can calmly regain your focus and perspective.

Rule 2: Sustain Attention. Sustained focus is now possible in your calm, grounded state. Stay connected to your intention: what is the goal of the moment, closely watching a client's muscle alignment in a training session, or connecting with a loved one—what are you calling your attention to focus on? Keep your thinking on-track and your plans in place before engaging with distractions around you. Begin to maintain your uni-focus, one task or client at a time, and set aside all other distractions for a precious period.

Rule 3: Apply the Brakes. Your focused brain also needs to be able to stop, just as surely as a good pair of brakes brings your car to a halt at a red light. From time to time, move the spotlight of your attention on asking whether you should continue to focus on the task at hand. When a new piece of information comes to you in the midst of an important task, stop and consider whether this new data point now trumps what just was priority #1. To be able to stop is vital—a thoughtful application of the brakes, not simply succumbing mindlessly to either hyper-focus or distraction.

Rule 4: Mold Information. Your brain has the remarkable ability to hold various pieces of information it has intently focused upon, analyzed, and processed, and then use this information to guide future action—even after the information is completely out of visual sight. This brain skill of gathering and holding your "working memory," allows you to simultaneously concentrate on the larger important task, while accumulating the data needed to better inform what you decide to do next. For example, you may think to yourself: "I asked my client to do x, then noticed y, and remembered z from a prior session, so I decide to switch to a new approach." Be intentional in your self-talk to draw on your working memory so you can quickly run different scenarios through in your head. Think beyond one moment in time, asking: how has my client responded in the past, and how did that work or not work?

Rule 5: Shift Sets. The combination of a well functioning working memory with the ability to shift your full attention quickly from task to task, a state of mental agility, leads to creative leaps in thinking. Rather than rigidly following a linear path, of say writing an article or designing a new exercise program without stop, allow your mind to jump, even leap, by welcoming the input of distractions or seeking out distractions (searching the web, reading a new article, having a conversation with a colleague) to generate new insights and ideas. Cultivate lightness in thought, be flexible and nimble, and be ready to move your full attention completely from one activity to another in the service of making new connections.

We are not talking about multi-tasking here. The brain is designed to focus only on one thing at a time. Multi-tasking leads you to an incomplete focus on all of the tasks, so that at the end of the day you feel you didn't do anything beautifully. Shifting sets is about shifting your full attention completely from one task to the next, shining all of your brain's resources on one activity at a time. Amazingly the task left completely behind benefits from the incubation period and when you return to it fully, new ideas will likely emerge.

Rule 6: Connect the Dots. Putting all of these "rules" together helps you stay on task in the moment, not succumb to distraction, and have creative ideas. It also moves you in the direction of connecting the dots, revealing a big picture and an organized mind in small or large

domains of your life. You may develop a clearer vision of what will work best for a client or a welcome, new perspective on where to direct your career.

Following these "Organize Your Mind" rules allows you to push the on and off buttons of your focus with calm intention. Soon you will find moments, then hours, then days and weeks of calm, sustained focus, mastering your impulses, and enjoying mental flexibility, creativity, and connectivity. Say goodbye to distraction and say hello to the beauty of an organized mind.

About the Author

Margaret Moore/Coach Meg, MBA, is the founder & CEO of Wellcoaches Corporation, a strategic partner of the ACSM, widely recognized as setting a gold standard for professional coaches in healthcare and wellness. She is co-director of the Institute of Coaching, at McLean Hospital/ Harvard Medical School and co-directs the annual Coaching in Leadership & Healthcare Conference offered by Harvard Medical School. She co-authored the ACSM-endorsed Lippincott, Williams & Wilkins *Coaching Psychology Manual,* the first coaching textbook in health care.

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1. Hammerness, P, Moore, M; *Organize Your Mind, Organize Your Life,* Harvard Health Books & Harlequin, 2012.

Walk Test *(continued from page 9)*

a prediction of mortality that can prove valuable to both PR staff and referring providers. This article has addressed some commonly asked questions from PR practitioners. Hopefully this information will help to ensure accurate and optimal 6MWT performance results in PR participants.

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SELF-TEST ANSWER KEY FOR PAGE 15

Question	1	2	3	4	5
Test 1	C	D	A	E	E
Test 2	B	A	E	D	C
Test 3	D	B	C	A	B

RESISTANCE EXERCISE PROTOCOLS FOR OLDER ADULTS

By Wayne L. Westcott, Ph.D.

The American College of Sports Medicine (ACSM) strongly advocates sensible resistance exercise for older adults.[2] Although similar to strength training programs for younger adults, several relevant research studies indicate that there are some age-specific differences in the resistance training responses of men and women over age 50. Based on this information, it would appear advisable for trainers to consider the following guidelines when designing and implementing resistance exercise protocols for older adults.

Training Frequency

Strength training textbooks typically recommend three weight workouts a week, but some research indicates that two weekly exercise sessions may elicit similar effects.[9, 18] In a study that included older adults, the 752 subjects who strength trained 3 days a week and the 892 participants who strength trained 2 days a week experienced equal gains in lean weight (3.1 pounds) after 10 weeks of otherwise identical exercise protocols.[18] McLester and associates[14] determined that more advanced younger exercisers (ages 18–30 years) required more than 2 days recovery time between successive strength training sessions to maximize muscle remodeling processes. Their more advanced older study subjects (50 to 65 years) did not increase strength beyond baseline levels at 48, 72, or 96 hours of recovery, which led the researchers to suggest that older exercisers may require longer recovery periods than younger exercisers (page 271).[14] It is therefore recommended that beginning older adults perform strength training 2 or 3 non-consecutive days a week. However, more advanced older exercisers who utilize higher training volumes are advised to allow 72 hours (3 days) recovery time between training sessions for the same muscle groups.

Training Sets

Four comprehensive analyses comparing the strength building effects of various training sets have produced inconsistent findings. An analysis by Carpinelli and Otto[8] concluded that single-set and multiple-set training protocols produced similar improvements in muscle strength. A meta-analysis by Rhea and colleagues[17] indicated that single-set training was not as effective as multiple exercise sets, with 4 sets per muscle group eliciting greater strength gains than fewer sets. More recently, a meta-regression by Krieger[13] determined that 2 to 3 exercise sets, but not 4 sets, were more effective than 1 exercise set for increasing muscle strength. In a quantitative analysis of single and multiple-set training, Wolfe and associates[20] found that both exercise protocols produced similar strength gains over the first weeks of training, but that multiple-set programs were more effective over longer training periods. Although these analyses of exercise sets did not specifically address older adults, the findings would appear to be applicable to older trainees. Single-set training significantly increased muscle mass in a 10-week study of more than 1,600 previously untrained adults and older adults (with no difference among age groups),[18] and in a 14-week study of de-conditioned elderly nursing home residents.[19] A reasonable recommendation is for older adults to begin strength training with a single set of 8 to 10 basic exercises, and systematically progress to 2 to 4 sets of resistance exercise for each major muscle group (pages 169-172).[3]

Resistance and Repetitions

With respect to muscle performance, there is an inverse relationship between the resistance that is used and the number of repetitions that can be completed. Although considerable variability exists with respect to exercise selection, resistance equipment, training status, and gender, it is generally accepted that most people can complete approximately 4 repetitions to volitional fatigue with 90% of maximum resistance (1RM), approximately 8 repetitions with 80% of 1RM, approximately 12 repetitions with 70% of 1RM, and approximately 16 repetitions with 60% of 1RM (page 23).[4] ACSM's exercise guidelines recommend that older adults begin strength training with resistance that permits 10 to 15 repetitions, which corresponds to about 65% to 75% of 1RM (page 193).[3] As their muscle and connective tissue become better conditioned and accustomed to resistance exercise, older trainees may progress to lower repetition protocols, such as 8 to 12 repetitions with approximately 70% to 80% of 1RM. Several studies with older adults have demonstrated excellent strength gains using training protocols of 8 to 12 repetitions.[7,15,18] It is therefore recommended that older adults typically train with resistance that enables 8 to 15 repetitions per set, although periodically using lower and higher repetition ranges (6 to 20 reps) should elicit similar muscular responses.[5, 6, 12]

Exercise Selection

According to the 2010 ACSM strength training guidelines, adults and older adults should perform 8 to 10 exercises that cumulatively address the major muscle groups (page 193).[3] The National Strength and Conditioning Association's textbook, *NSCA's Essentials of Personal Training*, recommends that older adults perform exercises for the following muscle groups: quadriceps, hamstrings, gluteals, pectoralis major, latissimus dorsi, deltoids, biceps, triceps, erector spinae, and rectus abdominis (page 469).[10] With respect to training exercises, *ACSM's Progression Models in Resistance Training for Healthy Adults* states that:

> "For improvements in strength and hypertrophy in older adults, the use of free-weight and machine multiple and single-joint exercises with slow to moderate lifting velocity for 1 to 3 sets per exercise with 60% to 80% of 1RM for 8 to 12 repetitions with 1 to 3 minutes of rest in between sets for 2 to 3 days per week is recommended" (page 699).[1]

Many older adults continue to participate in sport activities and have performance goals as they age. The age-related decline in muscle power exceeds the age-related decline in muscle strength, so exercise programs for this group of older adults should include power training.[2, 11, 16] Although power training can be employed with weight stack machines and free-weights, the momentum factor may render these exercise modes less accommodating than fast movements performed with pneumatic, hydraulic, electronic, or elastic resistance. An excellent power training activity is medicine ball throws, as the resistance increments can be gradually progressed and the balls can be released after the acceleration phase. This facilitates fast movement speeds without high musculoskeletal stress at the end of the exercise action, as the deceleration phase involves only the mass of the limbs rather than that of an exter-

nal resistance. When incorporating power training into the resistance training programs of older adults, a prudent suggestion would be to focus on high-velocity movements with lighter loads.

Summary

Resistance exercise is an effective means for increasing muscle strength and mass in older adults, thereby attenuating and reversing sarcopenia and associated degenerative processes and problems. The recommended training protocols for increasing muscle strength and hypertrophy in older adults include the use of free-weights and machines, the performance of 8 to 10 multiple and single-joint exercises that cumulatively address the major muscle groups, 1 to 3 sets per exercise with 60% to 80% of maximum resistance, 8 to 12 repetitions per set, 1 to 3 minutes recovery between sets, 2 to 3 non-consecutive days per week. Older adults with performance goals also are advised to perform some power training exercises, such as progressive medicine ball throws.

About the Author

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High-Intensity *(continued from page 7)*

pression in elite athletes is still controversial.

Carbohydrate supplementation is extremely important during prolonged duration exercise. Reductions in blood glucose levels have been linked to an increase in the release of stress hormones like cortisol.[11] Therefore, a study by Nieman *et al.* tested the hypothesis that carbohydrate supplementation during exercise could attenuate the release of stress hormones commonly seen during intense exercise.[10] This randomized, double-blind, placebo-controlled study consisted of 30 experienced marathon runners. Subjects were randomly assigned to placebo and carbohydrate supplement groups. Blood draws were taken prior to exercise testing following a 10 to 15 minute rest. Thereafter, subjects either ingested a 0.75 L carbohydrate beverage or an identical placebo. Every subject exercised at 75% to 80% of their $\dot{V}O_2$max for 2.5 hours and ingested 0.25 L of a carbohydrate beverage or placebo every 15 minutes of exercise. Carbohydrate supplementation showed a significant decrease in the release of cortisol ($P = 0.001$) and increase in the blood concentrations of neutrophils and monocytes ($P = 0.001$).[10] However, carbohydrate supplementation had no effect on blood monocyte phagocytosis.[10] Therefore, carbohydrate supplementation before and during exercise may attenuate the stress hormone release and increase neutrophil and monocyte blood concentrations, but may have no effect on their function.

These results were further solidified in a meta-analysis by Moreira *et al.* In the 24 studies included in the meta-analysis, all but one demonstrated a significant reduction in the release of cortisol post-exercise when a carbohydrate supplement was compared to a placebo. There continues to be no evidence on the effects of carbohydrate supplementation on preventing the reduction in IgA seen after high intensity, prolonged duration exercise.[7]

Glutamine is an important fuel for lymphocytes and macrophages and as such has been studied as a nutritional supplement.[11] Plasma glutamine levels decline post-exercise following strenuous exercise.[4] A randomized, placebo-controlled, double-blind study by Krzywkowski *et al.* considered the possibility of glutamine supplementation attenuating this post-exercise decline. Ten male athletes performed two bicycle exercise sessions on separate days. Each bout was performed for two hours at an intensity equal to 75% of each subject's $\dot{V}O_2$max. Subjects ingested either a glutamine or placebo supplement orally during each bout and up to two hours post-exercise. Glutamine supplementation eliminated the post-exercise decline in plasma glutamine levels.[4] However, this had no effect on lymphocyte and NK cell trafficking.[4] In the more recent meta-analysis by Moreira *et al.*, glutamine supplementation was found to have no effect on lymphocyte or neutrophil counts in any of the studies included.[7] Therefore, at this time glutamine supplementation is not recommended as a supplement to reduce exercise-induced immunosuppression in elite athletes.

Conclusion

High intensity, prolonged duration exercise challenges the immune systems of athletes. Effects often are more pronounced in elite athletes who commonly overtrain during the competitive season. Exercise-induced immunosuppression seems to increase an athlete's susceptibility to contracting URIs. Athletes consistently report higher incidences of URI symptoms, but it is important to be aware that symptoms may be indicative of the athlete's exposure to allergens or pollution rather than a true URI. Vitamin C and carbohydrate supplementation may help to reduce the post-exercise release of cortisol, but their effectiveness on reducing URI incidence in elite athletes is still controversial. Glutamine supplementation is not recommended at this time as a nutritional supplement.

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About the Author

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October–December 2011 Continuing Education Self-Tests

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SELF-TEST #1 (1 CEC): The following questions are from "Part 1: Aerobic Exercise During Pregnancy" published on page 4.

1. A first time mother seeks your advice on how often she should exercise while she is pregnant. She has just started her second trimester and has not previously been active. You suggest that she should try to exercise how many times per week?
   a. 7 days per week
   b. 5 days per week
   c. 3 days per week
   d. She should not begin exercise now.
   e. She can vary between 5 to 7 days per week.
2. A woman 14 weeks pregnant (beginning of second trimester) comes to the gym to ask about continuing her current exercise routine. She is not a competitive athlete and wants to stay fit and "do what is best for her child." What is an appropriate intensity level considering her background (sedentary)?
   a. Have her exercise until she can't have a conversation
   b. Have her keep her heart rate less than 150 bpm
   c. Rating of perceived exertion (RPE) < 12
   d. RPE between 12 and 14
   d. RPE > 18
3. One of your friends just found out she is pregnant. She is only 8 weeks along. Since she knows you are a trainer, she asks what type of exercise she can start now. What would be the best recommendation based on her previous lack of exercise activity?
   a. Swimming
   b. Running
   c. Cross-country skiing
   d. Basketball
   e. Outdoor bicycling
4. One of your usual client's tells you she is pregnant (about 10 weeks). She has been an active runner for more than 20 years. Usually, she runs 5 days per week for at least 45 minutes each session. She would like to continue her routine, but wants to know what is best for the pregnancy?
   a. She should wait until the second trimester to continue her routine
   b. She can exercise now, but stop during the third trimester
   c. She can run, but only for 30 minutes each session
   d. She should walk for 45 minutes instead of run
   e. She can continue her normal routine
5. Since the maternal body undergoes many changes as the pregnancy progresses, what special modifications should you educate your client's about concerning aerobic exercise?
   a. Wear a supportive bra
   b. Do not wear restrictive clothing
   c. Stay well hydrated
   d. Exercise in a comfortable environment (temperature, humidity)
   e. All of the above

SELF-TEST #2 (2 CECs): The following questions are taken from "Issues for Clinical Exercise Physiologists: The 6-Minute Walk Test in Pulmonary Rehabilitation" published on page 8.

1. Which of the following is not a contributing factor for improved 6-minute walk test (6MWT) performance in pulmonary patients?
   a. Taller height
   b. Shorter height
   c. Exercise training
   d. Walking on an oval track
   e. Male sex
2. Which of the following statements is incorrect?
   a. It is better to walk with the patient throughout the 6MWT to pull their oxygen tank and provide verbal encouragement.
   b. Normative 6MWT values are available for healthy middle-aged and older adults.
   c. It is not necessary for the patient to perform a warm-up prior to the 6MWT.
   d. Words of encouragement may influence 6MWT performance.
   e. 6MWT performance decreases with age.
3. The 6MWT helps the clinical exercise physiologist to:
   a. develop the exercise prescription from achieved peak heart rate, SpO_2 and RPE.
   b. assess the need for supplemental oxygen or adjust current oxygen titration levels during exercise.
   c. calculate estimated O_2peak for the pulmonary patient.
   d. All of the above
   e. Only a. and b. of the above
4. Performing the 6MWT on a treadmill is not recommended due to which of the following reasons?
   a. The pulmonary patient may not be able to pace him/herself properly, resulting in premature test termination due to fatigue.
   b. The pulmonary patient may be totally unfamiliar with walking on a treadmill.
   c. The pulmonary patient may not be able to walk even the slowest speed on the treadmill.
   d. All of the above
   e. Only a. and b. of the above
5. Which of the following statements is correct?
   a. It is best to have 2 to 3 trial tests immediately prior to the official 6MWT for the pulmonary patient.
   b. The 6MWT does not allow for rest periods to be taken.
   c. Results from the 6MWT can be used to track patient clinical outcomes pre- and post-pulmonary rehabilitation participation.
   d. The patient should not walk with a rollator during the 6MWT.
   e. There are currently no devices available to transmit exercise SaO_2 readings to the tester during the 6MWT.

SELF-TEST #3 (1 CEC): The following questions are taken from "Online Tips and Tools for Exercise Professionals" published on page 13.

1. Video clips include all of the following except:
   a. Vital Signs
   b. Chest Exam
   c. Neurologic Exam
   d. Skin Exam
2. The Online Physical Exam Teaching Assistant (OPETA) is a substitute for medical/treatment advice:
   a. True
   b. False
3. The service that provides peer review of online medical education discussed in this article is:
   a. AMA
   b. AHA
   c. MedEdPORTAL
   d. NHLBI
4. Videos provide information on all the topics listed below except:
   a. Making Diagnoses
   b. Proper Patient Positioning
   c. Auscultation Tips
   d. Palpation Tips
5. The OPETA page is designed as an aid to demonstrate acceptable technique expected of the:
   a. Typical Medical Resident
   b. First Year Medical Student
   c. Typical Medical School Graduate
   d. Typical Patient

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Farewells & Welcomes

As new co-editors of *ACSM's Certified News,* we wish to thank a few people for their vision, foresight, dedication, and service.

First, we wish to thank our predecessors, James "J.C." Churilla, Ph.D., MPH, RCEP, and Paul Sorace, M.A., RCEP, for implementing a series of enhancements that have helped make *ACSM's Certified News* a high quality, continuing education publication. JC and Paul established a regular column article feature in each issue of *ACSM's Certified News* by both a health and fitness and a clinical exercise physiology expert. They recruited Jon Ehrman, Ph.D., FACSM, as their clinical columnist and we have all enjoyed reading and learning from his "Clinical Column" articles over the last two years. Regretfully, Jon's term as clinical columnist has ended, and we must say farewell. In typical fashion, however, Jon is still committing his energies to serve the American College of Sports Medicine (ACSM), the clinical exercise physiology profession, and the community at large. Jon is currently serving as the umbrella editor for all new publications being released by ACSM over the next few years and co-editor of a new publication, *Clinical Exercise Physiology Reviews,* an official journal from the Clinical Exercise Physiology Association (CEPA). CEPA is a member of the ACSM Affiliate Societies. The first issue of CEPA's *Clinical Exercise Physiology Reviews* is scheduled for release in February 2012. We wish Jon much continued success and thank him for his dedication and service to ACSM.

Finding a successor for Jon has been challenging. He is a difficult act to follow. After careful consideration, we are pleased and fortunate to announce Paul Visich, Ph.D., M.P.H., as the new clinical columnist for *ACSM's Certified News.* Paul is the current chair and professor of the Exercise and Sports Performance Department at the University of New England in Biddeford, Maine and was previously a professor of health promotion and rehabilitation at Central Michigan University. Paul brings more than 35 years of experience as a researcher, author, clinical exercise physiologist, and educator to his new appointment as our clinical columnist. Along with Jon Ehrman, Steven Keteyian, and Paul Gordon, he served as a team editor of the textbook, *Clinical Exercise Physiology,* published by Human Kinetics. Paul served as a member of the Practice Board for ACSM's Registered Clinical Exercise Physiologist (RCEP) credential, the chairperson of the ACSM Professional Education Committee, and a member of ACSM's Committee on Certification and Registry Boards (CCRB). Paul has authored and co-authored numerous peer-reviewed and refereed articles and will be sharing his clinical knowledge and expertise with us and the readers of *ACSM's Certified News.* We are thrilled to have him as our new clinical columnist.