Online Tips and Tools for Exercise Professionals

PART 3:
Special Considerations for Exercise During Pregnancy
Exercise Deficit Disorder in Youth: Implications for Fitness Professionals
Blood Pressure Response to Resistance Exercise
HOW ARE ACSM EXAMS CREATED AND EVALUATED?

By Yuri Feito, Ph.D., MPH, ACSM-RCEP, CES; Jeff Soukup, Ph.D., ACSM-CES; and Dierdra Bycura, Ed.D., ACSM-HFS, CPT

Historically, the exams were created by content experts in the field of the particular certification area. These experts were on a sub-committee by certification level under the larger umbrella of ACSM’s Committee on Certification and Registry Boards (CCRB). It then became necessary to separate the duties of exam writing/evaluation and other duties required of the committees.

The Exam Development Team (EDT) was formed in 2006 in an effort by ACSM to maintain the integrity of the certifications and limit conflict of interest among members of the Committee on Certification and Registry Boards (CCRB) as required by the National Commission for Certifying Agencies (NCCA). The EDT is comprised of 10 ACSM certified professionals representing all certifications in both the clinical and health fitness tracks.

The team is diverse in its composition with several individuals holding academic appointments, several being health and fitness practitioners, and several being clinical practitioners. In addition, the team is diverse geographically with members hailing from the northeast to the southwest and many locales in between. The EDT is charged with the oversight of the certification exams, which includes the development and implementation of new exams and with the aid of a psychometrician, monitoring existing exams for proper performance.

The process of writing and reviewing new and current exam items requires the team to carefully evaluate each item for its scientific, practical, and grammatical correctness. The way that this is currently achieved by EDT is through group review and consensus. Items that are unsatisfactory by EDT standards may undergo two to three group reviews before acceptance in its final form. Because of this process and the volume of work to date, EDT holds two, one hour web-based conference calls each week for the purpose of exam item review.

Currently, with the help of the certification sub-committees, EDT is in the process of its most arduous task to date, the matching of all exam items to the newly defined job task analysis (JTA), which was finalized in early 2011. This requires that each item appearing on an ACSM exam be matched to the correct domain, task and knowledge/skill statement for that certification. The EDT anticipates
Learning Objectives

1. Identify reputable, online, education materials for themselves and their exercising clients/patients.
2. Describe the features within NIH MedlinePlus, the magazine.
3. Explain subscription options to NIH MedlinePlus, the magazine.

Exercise practitioners interested in obtaining current health, medical, and science information for themselves and for their clients and patients have access to a number of free, reputable, electronic resources and tools available through the National Institutes of Health (NIH). The NIH, a part of the U.S. Department of Health and Human Services, is the nation’s leading biomedical research agency and is the largest source of funding for medical research in the world. NIH is made up of 27 institutes and centers, each with a specific research agenda, often focusing on particular diseases or body systems.1

Readers interested in obtaining more information from a specific NIH institute can access it from the following link: http://www.nih.gov/icd/ Information contained within the NIH web pages are maintained and updated regularly.

NIH MedlinePlus, the magazine is an example of a number of such resources available through NIH. This article will describe briefly NIH MedlinePlus and how to access and subscribe to it. NIH MedlinePlus is a quarterly publication of NIH and the National Library of Medicine (NLM) and is considered a trusted source of health information.2 Its purpose is to provide readers with the best in reliable, up-to-date health information and present the latest breakthroughs from NIH-supported research in an easy to understand format. According to the Web site, NIH MedlinePlus presents the “latest breakthroughs from NIH-supported research.”2 NIH MedlinePlus features people (sometimes famous, but mostly average people) who have turned to NIH for care and want to share their stories. NIH scientists also write about their efforts to cure diseases. According to NIH MedlinePlus, “the magazine includes lively graphics, fun quizzes, and practical tips designed with your daily health in mind.”2

Each quarterly issue of the magazine contains an update on current “NIH Research,” approximately five feature articles, a section entitled “HealthLines,” and “NIH Quickfinder and NIH MedlinePlus Advisory Group” section. Recent feature articles have addressed health topics such as hypertension, cancer, peripheral artery disease, chronic pain in the elderly, asthma, and vision. Readers can obtain brief summaries of recent studies pertaining to lifestyle and health in the “HealthLines” section of the magazine. Readers interested in contacting one of the 27 NIH institutes or specific members of the MedlinePlus Advisory Group can do so through the “NIH Quickfinder and NIH MedlinePlus Advisory Group” section. Information printed within NIH MedlinePlus enables exercise professionals to keep their clients and patients abreast of important information pertaining to their health and fitness programs.

Readers can subscribe to the magazine at: http://www.nlm.nih.gov/medlineplus/magazine/subscribe.html Printed subscriptions are also available through Krames StayWell publications.

References

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Learning Objectives

- Explain how maternal exercise during pregnancy can benefit mother, pregnancy outcomes, and baby.
- Describe how to advise overweight or obese women on appropriate aerobic exercise during pregnancy.
- Describe how you would advise an overweight/obese patient on safe strength training exercises during pregnancy.
- Explain an appropriate and complete exercise program for overweight/obese women during pregnancy.

Being overweight while pregnant is one of the most common obstetric risks factors for maternal and fetal complications. Extra weight during pregnancy is associated with increased gestational risks, such as hypertension, eclampsia, diabetes mellitus, thrombophlebitis, labor complications, post-date delivery, cesarean delivery, along with delivery complications. For the offspring, the mother’s extra pounds are associated with increased fetal distress, increased congenital abnormalities, and lower Apgar scores at birth. These infants have an increased likelihood of being admitted to neonatal intensive care. An exercise program during gestation can possibly provide benefits for both mother and child, regardless of the mother’s pre-pregnancy BMI (Figure 1).

A common risk factor between gestational diabetes mellitus and obesity is physical inactivity. Physical activity during pregnancy may help to prevent or attenuate maternal-fetal diseases. The American Congress of Obstetricians and Gynecologists (ACOG) suggests preventative measures in overweight/obese pregnancy. Obesity is now considered a chronic inflammatory condition associated with metabolic overload, which is associated with oxidative, cellular, organelle physiological stress. Exercise leading to weight loss is considered anti-inflammatory and is associated with decreased inflammatory markers, and improved metabolic measures, such as insulin sensitivity. Similar findings are associated with the effect of physical activity during pregnancy, regardless of maternal BMI.

The association between fetal environment and adult health, or risk of chronic disease is growing stronger. Of particular concern for overweight, pregnant women is the mother’s ability to maintain appropriate nutrient levels to the developing fetus. In response to exercise training, overweight and obese women have similar resting heart rates, but improved oxygen consumption and ventilations relative to healthy weight pregnant women. Overweight pregnant women who exercise have normalized weight gain. Additionally, there are no differences in overweight/obese exercise and controls in incidence of cesarean delivery, and hypertension/pre-eclampsia. The altered metabolic state of hyperglycemia can influence the fetal development, such that the offspring develops obesity later in life. However there is evidence that exercise normalizes insulin and glucose levels, as well as decreases the prevalence of gestational diabetes mellitus (GDM), regardless of BMI. Birth weights are normalized in overweight/obese women who exercise during pregnancy. Another study found no difference between overweight pregnant exercisers or sedentary, pregnant women in incidence of low birth weight, prematurity, or Apgar scores (scores to assess general physical health of newborns) most likely due to the normalized physiology of the mother (i.e., weight gain).

Ultimately, all women should consult their physician to verify they are able to participate in aerobic exercise while pregnant. A pre-health screening survey, such as the PARmed-X (www.csep.ca/forms.asp), will provide information on current health status and potential concerns. After receiving physician clearance for physical activity, it is important to work with your pregnant client to set attainable and measurable goals throughout the pregnancy. Since education increases knowledge, but does not necessarily change behavior, an exercise program must be behavior-based and individualized.

Exercise Guidelines during Overweight Pregnancy

The second trimester is the most appropriate time to begin an exercise program for overweight/obese women. For this population, the main goals of beginning an exercise program during pregnancy are to improve maternal fitness and pregnancy outcomes. All physical activity should begin with a warm up to prepare the body for the demands of exercise. The warm-up should consist of 10 to 15 minutes of easy stretching, or slow walking. Next, aerobic and resistance training should follow. Lastly, women should spend about 10 to 15 minutes cooling down. A cool down should involve either light stretching or slow walking to restore heart rate to pre-exercise levels.

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General aerobic guidelines for any pregnant woman with a BMI greater than 25mL/kg2 (Table 1) is to exercise at a moderate intensity. The talk test, or the Borg’s Rating of perceived exertion (RPE) scale represent methods of monitoring intensity in a field setting. The range of 12 to 14 RPE represents moderate intensity and is appropriate. The frequency and duration should be less than the recommended ACOG guidelines, but gradually progress until the recommended level of exercise is achieved. For example, overweight, previously sedentary women should begin with 15 to 25 minutes of aerobic exercise 3 days per week. A steady progression of adding an additional 2 minutes per week is recommended until 40 minute sessions have been achieved. Next, a fourth day of exercise should be added for a total of approximately 150 to 160 minutes per week, since this frequency has been shown to improve glucose regulation, decrease insulin requirements, prevent excessive weight gain, and decrease prevalence of GDM. Activity 3 to 5 times per week also prevents small-for-gestational age babies, a risk for obesity and cardiovascular disease later in life. In order to individualize programs and maintain exercise engagement, clients should participate in at least one supervised exercise session; the remaining weekly sessions can be home-based. This model has effectively prevented or decreased weight gain during pregnancy.

Due to the excessive anatomical load and stress of the over-weight/obese morphometry, mode of exercise is of special consideration. It is best to choose a low risk, comfortable, enjoyable activity. To avoid potential harm to the enlarging maternal abdomen, ACOG recommends against activities that involve fast moving objects, such as ball sports or martial arts. To prevent fetal harm from falling, women should select activities which can be performed indoors such as indoor skiing, stationary cycling, or spinning, or indoor cross country skiing. Low risk aerobic activities including swimming, walking, jogging, swimming/cycling, aerobics classes are recommended, most aerobic equipment (i.e., stair climber, elliptical, rowing). Commonly selected activities might include water aerobics, walking, low-impact aerobics, or stationary bicycling.

After the first trimester, avoid activities in the supine position since these may decrease maternal circulation by compressing the inferior vena cava. Although swimming is a safe aerobic activity throughout pregnancy, pregnant women are more energy efficient during weight-bearing than non-weight bearing exercises. The most common aerobic activities for overweight, pregnant women are walking or pre-natal aerobics. These activities can be done with little expense, anywhere, and at varying intensities. Late pregnancy hormonal changes cause joint laxity coupled with excess weight and make these activities most appropriate. Pedometers are an effective means of increasing compliance in overweight/obese pregnant women. Allow your pregnant clientele to choose enjoyable, aerobic exercises that they can safely and comfortably perform.

**Resistance Training for Overweight Pregnant Women**

Strength training improves core fitness, and has been found to decrease insulin requirements for overweight women with GDM. Resistance training should involve strengthening core, lumbar, pelvic, and overall body strength. Scant research has been conducted in this area, but some studies have shown that about 15 to 30 minutes of strength exercises is beneficial. These exercises were arranged as a circuit with less than 1 minute rest between stations: plies or lunges, lateral pull down, knee extensions, seated row, hamstring curl, bench press, triceps press, military press, and core exercises. These nine exercise stations should be done three times per week with the following progression:

- Week 1 perform 2 sets of 12 repetitions each exercise,
- Week 2 perform 2 sets of 15 repetitions each exercise
- Week 3 perform 3 sets of 15 repetitions each exercise,
- Week 4 (until delivery) perform 3 sets of 20 repetitions each exercise.

As the rotund pregnant body continues to change, other modifications should be considered to ensure exercise is safe for the fetus and comfortable for the mother. Excess adipose tissue is an insulator. Exercise professionals should be cognizant of the overweight woman’s sense of warmth. Overweight pregnant women must exercise in an air-conditioned, environment that maintains a heat gradient away from the fetus. If she chooses to exercise outside, then the temperature should be cool, and comfortable. Additionally, she must always maintain water satiety before, during, and after exercise. Women should wear loose clothing to maintain circulation and comfort. They may feel more comfortable by having a belly band or sling and, sometimes consider wearing two to support their pregnant abdomen. Similarly, they should wear a supportive bra or two to ensure appropriate breast support. Women should feel comfortable while exercising.

**Summary**

It is especially important to have physician approval and a health screening before initiating an activity program for an overweight, pregnant client. The trainer and client should know when to stop an exercise session. It is safe for overweight/obese women to exercise throughout pregnancy and helps normalize pregnancy outcomes. Though overweight pregnant women must gradually work up to ACOG exercise guidelines, they can participate in aerobic and resistance training during pregnancy. For this population, it is of utmost importance to make sure your client is comfortable and hydrated during exercises. Also ensure the frequency, intensity, time, and type of exercise is appropriate, while improving fitness. Participating in physical activity during pregnancy will help improve pregnancy outcomes for women who are overweight/obese.

**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.

**References**


Pregnancy (continued on page 13)
EXERCISE DEFICIT DISORDER IN YOUTH: IMPLICATIONS FOR FITNESS PROFESSIONALS

By Avery D. Faigenbaum, Ed.D., FACSM, and Gregory D. Myer, Ph.D., FACSM

Computers and video games have decreased the need and desire to move, and in many neighborhoods there are fewer safe places for youth to engage in free play. Moreover, a growing number of school districts now view physical education as an expendable part of the school curriculum and only 18% of states require elementary schools to provide daily recess. Nationwide, fewer school-age youth participate regularly in moderate to vigorous physical activity (MVPA), and the rapid decline and disinterest in physical activity appears to progress steadily after age six. Physical fitness is recognized as a powerful marker of health in school-age youth, and concerted efforts are needed to identify inactive boys and girls before they become resistant to our interventions.

Identification of Inactive Youth

Since primary prevention is designed to prevent disease rather than treat it, the first step is to identify youth who do not participate regularly in school- and community-based physical activities that enhance both health- and skill-related components of physical fitness. Longitudinal research has found that children who are not exposed to environments with opportunities to enhance motor skill proficiency (e.g., jumping, hopping, and balancing) tend to be less active later in life. Physical fitness is recognized as a powerful marker of health in school-age youth, and concerted efforts are needed to identify inactive boys and girls before they become resistant to our interventions.

Over the past quarter century, the prevalence of overweight and obesity among children and adolescents has become a major public health concern and physical inactivity is now recognized as a fourth leading risk factor for global mortality for non-communicable diseases.

Learning Objectives
1. Understand the consequences of a sedentary lifestyle during childhood on health and fitness during adulthood
2. Explain the concept of exercise deficit disorder and how it applies to fitness professionals
3. Identify school- and community-based strategies to promote physical activity in youth

Since many diseases that become clinically manifest during adulthood are influenced by lifestyles habits established during childhood, it is important to identify youth who may be at increased risk for disease processes later in life. In the landmark Pathobiological Determinants of Atherosclerosis in Youth (PDAY) study, strong relationships were found between risk factors and the severity and extent of atherosclerosis measured after death in 15- to 34-year-olds who died accidentally of external causes. While there was a striking increase in the severity and extent of disease as the number of risk factors increased in the PDAY report, it is noteworthy that the absence of risk factors was found to be associated with a virtual absence of advanced atherosclerotic lesions. Since clinical events often are the result of lifelong pathological processes, targeted interventions are needed to manage identified risk factors in youth and establish healthy behaviors that reduce the risk of adverse health outcomes in the adult years.

In addition to unfavorable lipid levels, elevated systolic blood pressure and higher levels of obesity, the disadvantageous effects of a sedentary lifestyle on the overall health of children and adolescents must not be ignored. Increased time in sedentary behaviors has been linked strongly to higher levels of cardiovascular risk factors in youth, and a recent report found that low levels of habitual physical activity significantly increased the risk of injury in children aged 9 to 12 years.

Since contemporary youth are not as active as they should be, fitness professionals need to pay greater attention to the promotion of daily physical activity and lifestyle modification during the pediatric years to prevent the progression of risk factors and pathological processes.
Exercise Deficit Disorder

Exercise deficit disorder (EDD) is a term used to describe a condition characterized by reduced levels of regular physical activity that are below recommendations consistent with positive health outcomes. The use of this term highlights the gravity of this condition and can be used to raise public awareness about the importance of regular exercise for the developing body. Moreover, the concept of identifying youth with EDD conveys a contemporary view of this emerging health care issue that can be used to educate parents, school administrators, and government officials about the exercise-health link. Of note, the use of the term exercise in EDD does not suggest that free play is inconsequential, but rather emphasizes the premise that habitual physical activity may need to be “prescribed” by fitness professionals and health care providers for youth identified with this disorder. Viewed from this perspective, participation in age-appropriate play, games, sports, transportation, physical education, and planned exercise all can contribute to the physical and psychosocial development of a child.

While the optimal amount and type of physical activity may vary with age and exercise history, participating daily in at least 60 minutes of MVPA, which include aerobic games and fitness activities that strengthen muscle and bone, is consistent with current guidelines. The identification of asymptomatic children with EDD who do not participate in adequate MVPA can facilitate the development of a management plan that includes an exercise prescription as well as recommendations for achieving physical activity goals that are supported within the family structure. Conversely, screening methods that focus solely on the identification of overweight youth may delay the development of preventive strategies. Current trends in childhood overweight and obesity suggest that this traditional type of intervention is suboptimal and inconsistent with the goal of preventing diseases and conditions before they become apparent clinically.

While there are not any clinical markers or laboratory tests that can be used to identify youth with EDD, children can be queried about their “play history” and how many days per week they participate in games, sports, and recreational fitness activities. Asking follow-up questions related to the amount of time they are active in activities that make them “breathe hard” can shed light on both the quality and quantity of daily physical activity. When appropriate fitness professionals can consult with parents and develop an action plan that promotes regular exercise and removes barriers to a more active lifestyle. Fitness professionals also can establish links with school- and community-based resources while advocating for policies that promote daily exercise. Providing youth and their parents with guidelines for setting limits on screen media use (e.g., text messaging, video games, computing, and television) may prove to be beneficial particularly for children and adolescents who may need to increase time available for achieving adequate daily physical activity.

Qualified fitness professionals who genuinely appreciate the physical and psychosocial uniqueness of children and adolescents are well positioned to link health care with fitness care in order to create opportunities for youth with EDD to be physically active as part of play, sports, and planned exercise. In addition, fitness professionals should support daily physical education and sustainable community-based programs, which are needed to reduce the burden of poor health outcomes in school-age youth with the lowest levels of physical activity. By collaborating with teachers, community leaders, and health care providers, fitness professionals can help to expand opportunities for all youth to be physically active in the context of family, school, and community activities. If fitness professionals miss this window of opportunity to identify EDD in youth and promote healthy lifestyle choices, the eventual decline and disinterest in physical activity will begin to take shape and new health care concerns will continue to emerge.

About the Authors

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References

COACHING NEWS

CLIENT: JOB PROMOTION BRINGS MORE STRESS LEADING TO OVERSEATING AND UNHEALTHY FOOD CHOICES

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

This column continues the new format for our Coaching News column. We are exploring a variety of client scenarios, one scenario for each column. I describe a few tips from my science-based coaching toolbox to help you help your clients engage fully in a fit lifestyle that allows them to thrive, whatever thriving means in their lives.

Today, we explore how to coach a client whose work responsibilities bring increased stress leading to unhealthy food choices and overeating. First, let’s explore how stress leads to poor health choices. The brain’s region for self-direction, self-control, self-management, and self-coaching is the prefrontal cortex (PFC), behind our foreheads (the red area in the Figure), which I like to describe as the CEO domain of the brain. The PFC at its best appreciates and deftly manages our negative emotions, and drives our attention and focus so we are calm, organized, creative, wise, strategic, and productive.

The conditions that enable optimal function of the prefrontal cortex include a calm, positive, and energetic mindset supported by a healthy, fit, well-nourished, and well-rested body. When we are tired, stressed, unfit, and poorly nourished, when our emotional weather report is negative or “cloudy,” the PFC is impaired. It struggles to stay in control and on top of distractions, impulses, and stay focused on doing a good job on the task at hand.

A calm and energetic PFC can:

• Set overwhelm aside and enjoy a focus on the task at hand
• Stay focused on meaningful goals and a higher purpose, resisting temptations that are in fact “error” messages
• Recognize that cravings (checking texts, junk food, etc.) and negative emotions fade and go away like clouds in the sky
• Be self-compassionate and not indulge the inner critic
• Find the positive silver linings in stressors and negative emotions, thoughts, and events
• Detach from a negative emotional weather report to get a strategic perspective (“maybe I’m overreacting…”)

A depleted PFC is hijacked easily by:

• Overwhelm caused by a daunting to-do list
• Cravings for “addictive” foods and drinks
• The negative self-talk of a mean inner critic, triggering the inner rebel to make an unhealthy choice
• A negative emotional weather pattern, clouding the ability to notice and savor positive moments
• An overdose of stress, leading us to feel out of control

How can you help your clients improve the function of the PFC and its capacity to manage negative emotions and stress?

• Exercise: Over time, regular exercise leads to a strengthening of the PFC and its capacity to manage negative emotions and stress.
• Brain breaks: Take brain breaks where you allow your mind to wander, or move your mind’s attention to your heart through deep breathing, or move your muscles through a few stretches or strength exercises. Even 2 to 5 minutes of walking, stair climbing, or yoga poses will refresh the PFC. Nothing is better than a good night’s sleep, or even a catnap to hit the PFC’s reset button.
• Self-compassion: Turn your inner critic into your inner friend. Be kind to yourself. Negative self-talk is particularly depleting.
• Mindful practices: Take deep breaths or do short meditations to unhook the mind from the frenzy of out-of-control thoughts and emotions. Create mental pauses when making decisions on eating and exercise to give the PFC a moment to get back into the driver’s seat. Regular meditation also improves PFC function over time.
• Savor and cultivate positive emotions: Positive emotions were designed to be fleeting, like butterflies, in contrast with negative emotions, which move lightning fast and stick like Velcro. Positive emotions improve cognitive function, in contrast with the impairment caused by negative emotions. Cultivate a ratio of at least three positive emotions for each negative emotion (check out your ratio at www.positivityratio.com) so that you have the cognitive resources to manage or overcome the negative in your life.
• Connect with people you care about: The most powerful positive emotions “lighting up” our brains are those we share with others.

Coaching (continued on page 14)
Hypertension, a major risk factor for cardiovascular disease, is experienced by approximately one-third of American adults. There has been concern that strength training may adversely affect blood pressure in two ways: (1) by abruptly increasing blood pressure to unsafe levels during exercise performance and (2) by progressively raising resting blood pressure readings over time. In fact, there is evidence that training to failure with very heavy weight loads can raise blood pressure to extremely high levels during exercise execution. Fortunately, research indicates that standard strength training produces exercise blood pressure responses similar to those associated with standard aerobic activity. Furthermore, numerous studies have shown that both standard resistance exercise and circuit strength training lead to favorable blood pressure adaptations after two or more months of training.

**Acute Blood Pressure Responses to Resistance Exercise**

The changes in blood pressure during and immediately after a bout of strength training are known as acute blood pressure responses to resistance exercise. A study in which experienced bodybuilders performed as many repetitions as possible with very heavy weight loads (i.e., 95% of maximum resistance) revealed exceptionally high acute blood pressure responses. Peak systolic blood pressure averaged 320 mmHg during the leg press exercise, and 255 mmHg during the single-arm curl exercise. Such extreme elevations in systolic blood pressure would caution against training to failure with near-maximum resistance on a regular basis. However, a similar research study that examined the acute effects of standard strength training protocols on systolic blood pressure found much lower peak pressures. The 24 study participants (mean age 38 years) completed sets of 10 repetitions each using different percentages of their 10 repetition maximum (10RM) weight load in the preacher curl exercise. They performed dumbbell curls with their right arm while blood pressure was monitored continuously in their left arm. Exercising with higher percentages of the 10RM weight load produced correspondingly higher systolic blood pressure readings, the highest of which was attained with the 10RM resistance (approximately 75% of maximum). During each exercise set systolic blood pressure increased gradually and progressively on successive repetitions, reaching the highest level during the final repetition. On average, the participants’ systolic blood pressure increased by 34% from rest to the point of momentary muscle fatigue (123 mmHg to 165 mmHg). This response was well below the 250 mmHg critical level for exercise systolic blood pressure recommended by the American College of Sports Medicine (ACSM (page 83)). This response was also similar to the 35% increase in systolic blood pressure experienced by the same study subjects during a 20-minute session of stationary cycling performed at 75% of their age-predicted maximum heart rate.

Based on the findings from these studies, it would appear that the acute systolic blood pressure responses to standard sets of (single-arm) resistance exercise using the 10RM or lower weight loads are well within the recommended range (below 250 mmHg), and may be comparable to the acute systolic blood pressure responses to standard (cycle) aerobic activity. However, training to failure with more than 90% of maximum resistance has been shown to raise systolic blood pressure above the recommended range, suggesting that such training protocols may not be appropriate for all exercisers (e.g., older adults, hypertensive individuals, etc.).

**Chronic Blood Pressure Adaptations to Resistance Exercise**

The changes in blood pressure over time (e.g., following 10 or more weeks of strength training) are referred to as chronic blood pressure adaptations to resistance exercise. A study of more than 1,600 adults (ages 21 to 80 years) revealed significant reductions in resting systolic and diastolic blood pressure following 10 weeks of combined strength and endurance exercise. The study participants performed approximately 20 minutes of resistance training and 20 minutes of aerobic activity, two or three days a week. The strength training program consisted of 10 standard machine exercises using a resistance that could be properly performed for one set of 8 to 12 repetitions (about 70% to 80% of maximum resistance).

The participants who trained twice a week significantly reduced their resting systolic and diastolic blood pressure readings by 3.2 mmHg (128.7 to 125.5 mmHg) and 1.4 mmHg (76.1 to 74.7 mmHg), respectively. Those who trained three days a week significantly reduced their resting systolic and diastolic blood pressure readings by 4.6 mmHg (127.9 to 123.3 mmHg) and 2.2 mmHg (78.0 to 75.8 mmHg), respectively.

Two other studies that examined the effects of combined strength and endurance exercise on resting blood pressure also found favorable outcomes. In the first study, hypertensive middle-aged adults experienced reductions of 13 mmHg in both systolic and diastolic blood pressure. In the second study, hypertensive older adults experienced reductions of 5.3 mmHg in systolic blood pressure and 3.7 mmHg diastolic blood pressure.

With respect to strength training alone, research has revealed significant decreases in resting systolic and/or diastolic blood pressure after two or more months of resistance exercise. A meta-analysis of ran-
Rate, regularity and rhythm are the fundamental 3 Rs of heart auscultation. Rates that fall within a normal range as well as abnormal rates, bradycardia (a heart rate of < 60 bpm) or tachycardia (a heart rate of >100 bpm) can have a rhythm that is regular or irregular. Abnormal rhythms can be intermittent or persistent in response to numerous physiological and pathological conditions affecting the structure, conduction and/or contraction of the heart. The key to evaluating the significance of abnormal rates and rhythms is in obtaining a thorough history including level of fitness, health history, medication regimes, associated symptoms, diet, and other potential triggers. Different forms of cardiac testing may be utilized to evaluate abnormal rates or rhythm including ECG assessment, echocardiography, stress testing, and holter or event ECG recording as needed. Skillful heart auscultation can be very helpful in the identification of potential cardiac pathologies.

Abnormal Sounds

S1 and S2 are the normal sounds discussed in Part 1. A third heart sound, S3 which follows S2 can be detected in some individuals. It can be heard in healthy children, young adults, and in pregnancy but warrants further evaluation as it may be present in structural defects or conditions such as ventricular septal defect, mitral regurgitation, or congestive heart failure. In children and young adults, the S3 sound is produced due to a deceleration of blood against the ventricular wall.1 If S3 is heard in older adults it is commonly referred to as a “S3 gallop” and is more indicative of a pathological condition that is associated with poor ventricular compliance. A left sided S3 is best heard at the apex of the heart (4th-5th intercostal space, mid-clavicular line) with the bell of the stethoscope while the patient is in the left lateral decubitus position. A right sided S3 is best heard at the lower left sternal border. The S3 mimics a low pitched gallop sound described using the word “Ken-tucky,” whereby the third sound lands quickly after S2. Ken (S1) tuck (S2) y (S3), with the emphasis on “y.” The fourth heart sound, S4, is not normally heard in healthy adults and when heard is considered a strong indication of a myocardial infarction or conditions that are associated with poor ventricular compliance.2 It is best heard at the apex with the bell of the stethoscope while the patient is in the left lateral decubitus position holding their breath. The S4 sound mimics a gallop as well and is described using the word “Ten-nes-see,” whereby the fourth heart sound occurs immediately before systole; Ten (S4) nes (S1) see (S2), with the emphasis on “Ten.” Tapping these words out on a table with your fingers can help to establish the cadence that you would be hearing with these abnormal sounds.

Other abnormal sounds can be described as; clicks (split S1 or split
Heart murmurs are characterized as innocent/physiologic or pathological. They are progressively graded from Grade 1 through Grade 6 based on intensity; Grade 1 being barely audible to Grade 6 being audible with the stethoscope off of the chest. They are further characterized based on the timing, whether they occur during systole, diastole or are continuous throughout the cardiac cycle; the location, based on where they are best heard, the aortic area or pulmonic area for example; the presence of sound radiation to the back, apex or carotids; the quality, musical, vibrating, harsh or blowing; the pattern, crescendo or decrescendo and finally, the pitch, low, middle, or high. Different types of murmurs are heard best at different areas of the heart and their characteristics vary depending on the type of abnormality present. The evaluation of murmur characteristics helps the clinician to determine its source and clinical significance.

Practicing auscultation enhances your proficiency in identifying normal and abnormal heart sounds. New clinicians are strongly encouraged to spend time listening to these different heart sounds that are freely available on many web sites such as:

- www.easyauscultation.com/

Part 3 of the heart sounds series will discuss how to correlate the audible heart sounds associated with the more common pathological heart conditions that you may encounter when working as a CEP in diagnostic testing or cardiac rehabilitation.

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**About the Author**

Paul Visich, Ph.D., MPH, 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 ACSM’s Certified News 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.

**References**

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Exams (continued from page 2)

finalization of the project by the middle of 2013, which corresponds to publication dates of the primary certification materials. Along with the JTA conversion project, ACSM is implementing a new software program that will be used in the development and maintenance of all certification exams along with the administrative tasks of certification that are kept up with on a daily basis. EDT will use this software in their daily efforts to write and review exam items. Of course, this requires each member of EDT to undergo appropriate training on the use of the software program. Training is underway now and should be concluded by early summer.

It may be of interest to know that EDT favors the use of ACSM certification resources when developing exam items for certifications. This does not mean that other resources are excluded, just not preferred. The following texts serve as the backbone of reference materials used by EDT to develop and implement appropriate exam items:

- ACSM’s Guidelines for Exercise Testing and Prescription
- ACSM’s Resources for Clinical Exercise Physiology
- ACSM’s Exercise Management for Persons with Chronic Diseases and Disabilities
- ACSM’s Resources for the Personal Trainer
- ACSM’s Resources for the Group Exercise Instructor

In summary, the Exam Development Team attends to the details of making sure that the exams you sit for meet national accreditation standards and continue to represent ACSM’s gold standard of excellence!
domized controlled trials by Kelley and Kelley (2000) concluded that resistance exercise is effective for reducing resting blood pressure. A more recent meta-analysis of randomized controlled trials by Cornelissen and Fagard (2005) reached the same conclusion. According to the study authors, resistance exercise was associated with a 6.0 mmHg decrease in resting systolic blood pressure and a 4.7 mmHg decrease in resting diastolic blood pressure in nonhypertensive populations. They also determined that the reductions in resting blood pressure were similar for both strength training and aerobic activity.

A 2012 study with hypertensive middle-aged men showed significant reductions in resting blood pressure following 12 weeks of standard strength training (3 sets, 12 repetitions, 60% of maximum resistance, 3 days a week). On average, the 15 study participants experienced a 16 mmHg decrease in resting systolic pressure (150 to 134 mmHg), and a 12 mmHg decrease in resting diastolic pressure (93 to 81 mmHg). Additionally, the reduced blood pressure readings remained stable for four weeks after the training program (without any exercise performance).

**Summary**

The results of these studies indicate that standard strength training (sets of 10 repetitions with approximately 75% of maximum resistance) does not elevate blood pressure to unsafe levels during exercise performance, and that resistance exercise alone or in combination with aerobic activity is effective for reducing both systolic and diastolic resting blood pressure in normotensive and hypertensive adults after two or more months of training. However, there is evidence that training to failure with more than 90% of maximum resistance can raise blood pressure beyond recommended levels, and, therefore, such exercise protocols should be used cautiously.

**Practical Considerations**

With respect to practical considerations, it is recommended that strength training participants do not hold their breath during resistance exercise performance as this may further increase blood pressure response. ACSM recommends that trainees maintain a regular breathing pattern that typically involves exhalation during the lifting phase and inhalation during the lowering phase of each exercise repetition (page 172). It also is advisable for at-risk individuals to avoid straining and sustained tight gripping, as these actions may evoke excessive blood pressure responses (page 221). Finally, persons with cardiovascular concerns should be cautioned against holding a heavy resistance in a static position for more than a moment, as isometric exercise may cause greater blood pressure elevation than dynamic exercise. According to ACSM, “Proper resistance exercise techniques employ controlled movements through the full range of motion and involve concentric and eccentric muscle actions” (page 170).

**About the Author**

Wayne L. Westcott, Ph.D., teaches exercise science at Quincy College in Quincy, MA, and serves on the executive committee of the New England Chapter of ACSM.

**References**

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