Youth Physical Fitness:

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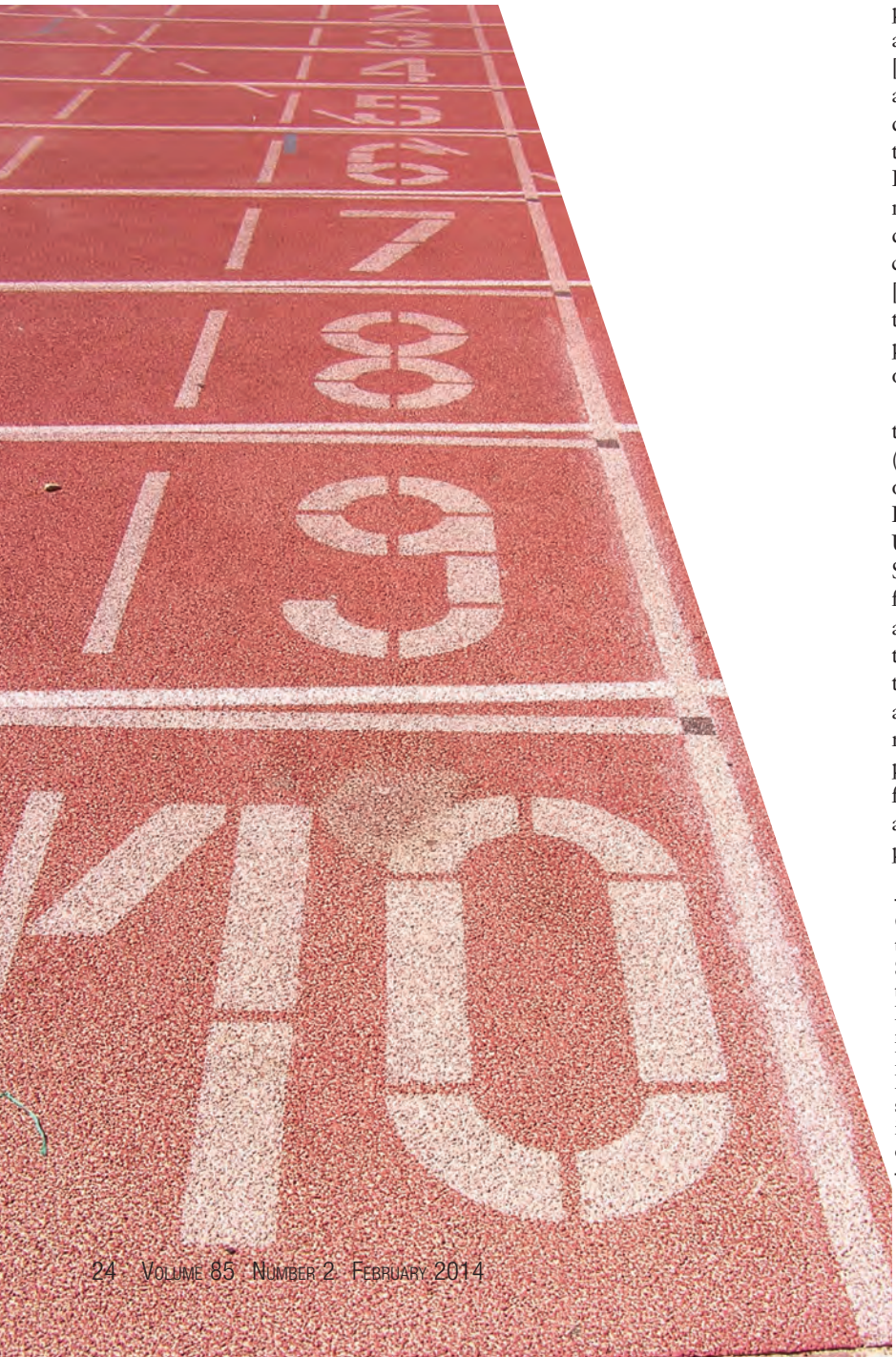

The promotion of physical fitness has been a key objective of physical education for more than a century (Park, 1988). During this period physical education has evolved to accommodate the changing views on fitness and health. Epidemiological research has clearly demonstrated the health benefits of physical fitness and physical activity, both for youth and adults (U.S. Department of Health and Human Services [USDHHS], 1996, 2008). The high incidence of obesity among youth has also resulted in school programs being designed to increase physical activity and improve nutrition (American Alliance for Health, Physical Education, Recreation and Dance [AAHPERD], 2013a, 2013c). Finally, the link between regular physical activity and academic achievement has been more clearly defined in recent years (Centers for Disease Control and Prevention [CDC], 2010). All these factors have led to increased attention from medical groups, public health agencies, nonprofit foundations, and other national and international organizations.

One of the most significant developments is the establishment of the Presidential Youth Fitness Program (PYFP), a partnership between the President's Council on Fitness, Sports and Nutrition (PCFSN), the Cooper Institute, AAHPERD, the CDC, the Amateur Athletic Union (AAU), and the National Foundation on Fitness, Sports & Nutrition (NFFSN). The PYFP is a model for fitness education that includes the use of a health-related assessment, as well as educational and motivational tools to support teachers and empower students to adopt active lifestyles. Three core areas of focus for the PYFP are assessment, professional development, and motivational recognition (see Figure 1). The FITNESSGRAM® (FG) program, developed by an esteemed advisory board affiliated with the Cooper Institute in Dallas, Texas, is the adopted health-related assessment of the PYFP. Over the past 25 years FG has helped lead the transition toward

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TEN KEY CONCEPTS

health-related fitness (Plowman et al., 2006; Welk & Meredith, 2008). The linkage with the PYFP dramatically increases the scope and reach of the FG program.

The FG battery of test items and associated fitness standards are key components of the PYFP and are now available for free to schools across the country. The supplemental FG v10.0 software and associated web-hosting services provide schools with a comprehensive solution for tracking, monitoring, and promoting physical activity and physical fitness in youth. In addition to the Cooper Institute, the other partners of the PYFP play an important role. The direct affiliation of AAHPERD within the PYFP brings essential education and professional expertise to the program. Students and schools will also receive recognition for their efforts through an expanded reward system coordinated by the AAU. The CDC provides support through its oversight of the program evaluation. The goal of the program is to reach 90% of our nation's schools by the year 2020. The NFFSN is working to secure financial resources that will support the provision of supplemental resources, such as the FG10 software, training for teachers, and recognition items for students for schools.

Other cooperative efforts are also underway to promote physical activity and healthy lifestyles among youth. For example, CDC and AAHPERD released guidelines and strategies for establishing comprehensive school physical activity programs (CSPAP). The stated goal of the CSPAP movement is

> to develop physically educated students who participate in the nationally-recommended 60+ minutes of physical activity each day and develop the knowledge, skills, and confidence to be physically active for a lifetime. (AAHPERD, 2013c)

Quality physical education is the centerpiece of the CSPAP vision. *Let's Move*! Active Schools (LMAS, www.letsmove.gov/active-schools), a program launched by First Lady Michelle Obama in partnership with PCFSN, AAHPERD, and the Alliance for a Healthier Generation, supports the CSPAP vision. This program is positioned to help schools "create active environments where students get 60 minutes of daily physical activity through quality physical education and physical activity before, during, and after school" (AAHPERD, 2013a, p. 1).

An integrated set of school-based programming has also been developed by the National Football League (NFL) Foundation in partnership with the National Dairy Council (Fuel up to Play 60) and the American Heart Association (NFL Play 60 Challenge). These programs have increased awareness about the importance of youth physical activity and have provided schools with tangible support to create positive change. Organizations such as Action for Healthy Kids, PE4 Life, and the Alliance for a Healthier Generation have also established national training and support networks to assist schools in creating a healthier environment. The visibility and accessibility of these and other programs has helped to build momentum for enhanced physical education programming in the United States.

As noted earlier, there has been increased attention and visibility given to physical education by the medical and public health communities in recent years. The prominent Institute of Medicine (IOM) recently released two significant documents focused on advancing youth fitness research and promotional efforts. The first report, titled *Fitness Measures and Health Outcomes in Youth* (IOM, 2012), focused on recommending health-related test items for use in national surveys of youth physical fitness. The committee that prepared the report reviewed the evidence to determine the link between fitness components and health outcomes in youth. In addition, the committee made recommendations for health-related fitness test items for use in school settings. The second report, titled *Educating the Student Body: Taking Physical Activity and Physical Education to School* (IOM, 2013), reviewed the literature to determine the current status of physical activity and physical education in the school environment. The report highlights the role that physical activity plays in enhancing student learning and describes how physical education and other school-based activity programming can contribute to creating a healthier school environment.

The convergence and synergy among these various developments has led to many opportunities but also has led to some confusion about how to interpret and act on the various programs and resources. The purpose of this article is to summarize key concepts and principles common across these initiatives. Specific emphasis is placed on issues with fitness assessment and fitness education since they are central to the PYFP and the IOM recommendations. The implementation of the PYFP, using FG as the health-related assessment, creates an unprecedented opportunity for coordinated programming that addresses education goals as well as public health objectives. It eliminates the confusion that existed when multiple organizations offered multiple tests and offers potential for coordinated fitness education and evaluation of school activity programming. To facilitate effective coordination, it is important to build consensus on common terms and principles underlying

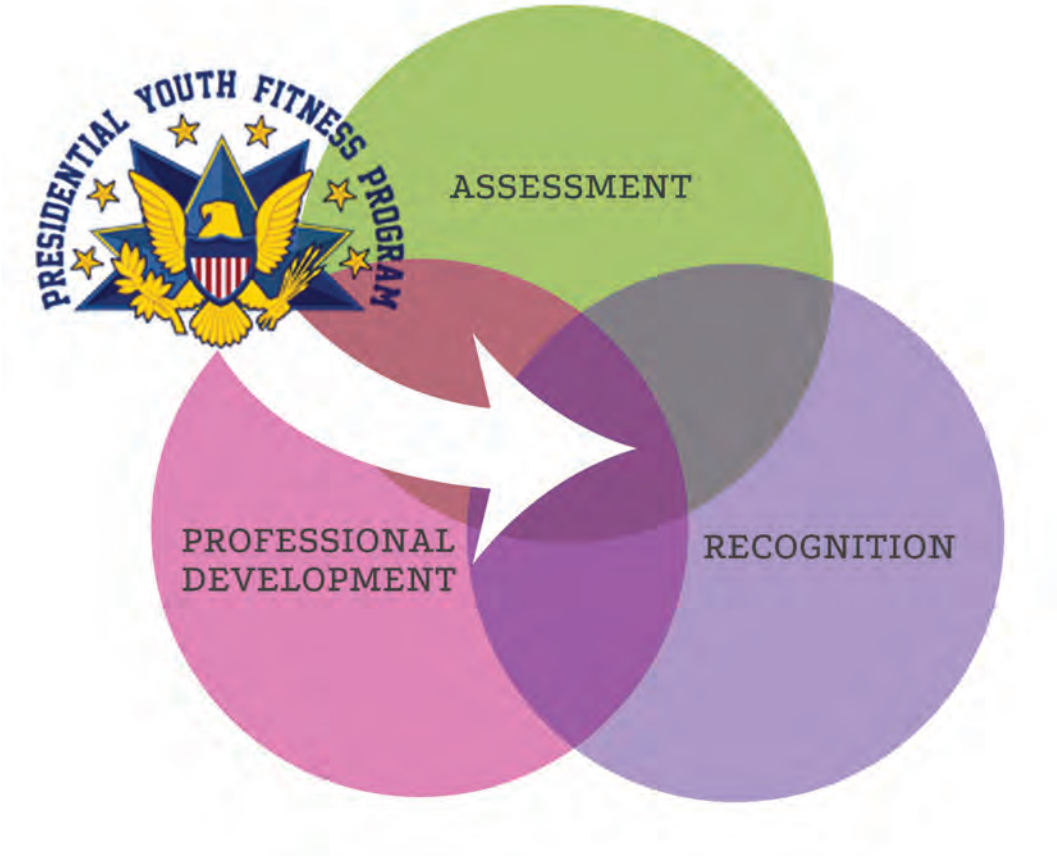

Figure 1. The three components of the Presidential Youth Fitness Program

physical education, fitness assessment, and fitness education. Ten key concepts, developed by representatives from the organizations involved with the PYFP are outlined here.

Ten Key Concepts

1. *Fitness education is an important part of the total physical education program.* Fitness education can be viewed as a subcomponent of a CSPAP that focuses on helping students acquire knowledge and higher-order understanding of health-related physical fitness (the product), as well as habits of physical activity and other healthy lifestyles (the process) that lead to good health-related physical fitness, health, and wellness. In 2012 the document *Instructional Framework for Fitness Education in Physical Education* outlined the scope of fitness education within physical education (National Association for Sport and Physical Education [NASPE], 2012). Although the term *fitness* is used in many ways, fitness education in this document was defined intentionally as health-related fitness education. The framework emphasized how instructional strategies can be used to teach important concepts of health-related fitness in youth.

The combined resources and partners within the PYFP provide schools (and teachers) with an integrated package to facilitate effective fitness education, since it "provides children, parents, and physical education teachers with valuable information to: better understand personal health-related fitness, create individualized fitness plans, and help students reach fitness goals and improve well-being" (AAHPERD, 2013c). The Physical Best (PB) program, developed by AAHPERD (2013b), has provided a comprehensive health-related fitness education program for many years. Physical Best has now added training programs specifically for use with PYFP. These programs combine elements of traditional PB programs with information on FG, the use of recognition items, and information about the importance of communication for program success (i.e., communication with students, parents, colleagues, administrators, and the community).

In addition to providing fitness education materials, PB provides health-fitness specialist and health-fitness instructor workshops and certifications and works collaboratively to provide instructor training for the fitness education program Fitness for Life (2013), a long-time partner program with FG and PB. Fitness education programs that focus on conceptual learning and teaching self-management skills have been shown to be effective in promoting active lifestyles after high school graduation (Dale & Corbin, 2000; Dale, Corbin, & Cuddihy, 1998). These results demonstrate that specific attention on fitness education can help foster lifelong interest and involvement in physical activity. The recent IOM report on physical education (IOM, 2013) specifically endorsed the importance of

fitness education in physical education programs consistent with the AAHPERD instructional framework (NASPE, 2012).

2. *Health-related physical fitness assessment is an important part of physical education and fitness education programs*. Fitness testing has been a common component of most physical education programs, but it has not always been used effectively to promote health-related fitness. Early debate in the field led some to question the utility of fitness assessments, but there is clear consensus by medical and public health experts concerning the importance of well-conducted fitness assessments in school physical education programming (IOM, 2012). A recent paper by Pate, Welk, & McIver (2013) revisits early justifications for coordinated fitness testing (Pate, 1989) and highlights the importance of physical fitness assessments in physical education. The recent AAHPERD fitness education framework also emphasizes the importance of "physical fitness assessment (including self-assessment) and analysis" (NASPE, 2012, p. 3).

The FG Scientific Advisory Board described appropriate and inappropriate uses of fitness assessment in its *Reference Guide* (Corbin & Pangrazi, 2008a), and other experts have provided recommendations for conducting valid and reliable fitness testing (Mahar & Rowe, 2008), guidelines for incorporating testing into the curriculum (Silverman, Keating, & Phillips, 2008), strategies for using fitness testing to enhance motivation (Wiersma, 2008), and recommendations for combined fitness and physical activity assessments (Welk, 2002). These resources provide abundant help to those who administer youth fitness testing.

3. *The relationship between health-related fitness and health varies by age, but it exists for people of all ages*. The classic epidemiological study by Blair et al. (1989), at the Cooper Institute, was among the first to clearly establish the link between fitness and cardiovascular health. Since then, evidence has accumulated, and the association between health-related fitness components and health risk factors in adults (e.g., cardiovascular risk factors, musculoskeletal health, diabetes, obesity) is well established (USDHHS 1996; ACSM, 2013).

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The links are not as robust for youth as for adults, partly because chronic disease states are not typically present among youth to the extent that they are among adults. Also the majority of studies, to date, have focused on adults. While health problems associated with low fitness are more characteristic of adults, the recent IOM report establishes a health link to physical fitness among youth (IOM, 2012). For youth, the term *health markers* (or health risks) is/are used rather than *health outcomes*, as used with adults. This is because health outcomes (e.g., disease) are not commonly present in youth but markers may be. Examples of markers that increase the risk for future disease include higher than normal blood pressure, blood sugar, blood lipids, and body fat levels.

The association between health and fitness is well established for cardiorespiratory endurance and body composition among adults (ACSM, 2013), and the recent IOM report documents the association of health markers with both cardiorespiratory endurance and body composition among youth (IOM, 2012). The FG program used a composite indicator of metabolic syndrome (health markers) to establish the health-related, criterion-referenced standards for both cardiorespiratory endurance (Welk et al., 2011) and body composition (Laurson et al., 2011).

The ACSM noted that "the health benefits of enhancing muscular fitness are well established" (2013, p. 179). Among adults, improved strength, muscular endurance, and power are related to a variety of health benefits (e.g., lower mortality, lower risk of heart disease, better metabolic profiles, lower risk of osteoporosis) and reduce the chance of musculoskeletal disorders (ACSM, 2013). The appropriateness of resistance training for youth was questioned until recent years, but new guidelines from the National Strength and Conditioning Association (Faigenbaum et al., 2009) indicate that properly conducted programs are appropriate for youth. Although the associations of strength, muscular endurance, and power are not as strong among youth as among adults, the IOM report (2102) documents the relationship between these fitness components and health markers, especially bone health, among youth. Interestingly, the relationship between muscle power and health is more established among youth (IOM, 2012) and older adults (ACSM, 2013) than it is among young adults.

Health associations with flexibility are apparent among adults (especially older adults; ACSM, 2013), but evidence of clear associations with health indicators in youth is lacking (IOM, 2012). This may be due to the generally high levels of flexibility in youth, the limitations of the existing measurements of flexibility, or the relative lack of research linking flexibility and health in youth. Despite the lack of evidence, assessing flexibility among youth is considered appropriate in fitness education (IOM, 2012). Among older adults, balance and agility, typically considered to be skill-related fitness components, are associated with good physical functioning, especially for reducing and preventing falls. Functional fitness and functional fitness training are especially important for seniors (ACSM, 2013).

4. *Although the strength of health relationships varies for different parts of fitness among youth, it is important to teach about all health-related fitness components in fitness education programs*. As noted in the previous concept, there are clear health links with both cardiorespiratory

endurance and body composition. The link to muscle fitness (strength, muscular endurance, and muscle power) among youth has also been established, but to a lesser extent than to cardiorespiratory endurance and body composition (IOM, 2012; Plowman, 2008). In fitness education, musculoskeletal fitness typically refers to the parts of health-related fitness associated primarily with the muscular and skeletal systems (strength, muscular endurance, power, and flexibility). Muscle fitness is often used to describe the parts of musculoskeletal fitness that rely on force production by the muscles. While not enough evidence has accumulated to show the health benefits of flexibility in youth, the IOM recommends flexibility testing in fitness education programs (IOM, 2012).

Teaching youth about physical fitness, its health benefits, and methods for developing each fitness component can help youth avoid health problems. In addition, it can help them to stay active throughout their lifetime (IOM, 2013). Establishing a healthy fitness profile early in life is easier than improving a low fitness profile that progressively develops as a result of an inactive adult lifestyle.

5. Functional fitness is an important consideration in fitness education. Functional fitness refers to the ability to perform "common movements you might do at home, at work or in sports" (Mayo Clinic, 2013). If youth "can do school work, get to and from school and participate in leisure time activities without fatigue, respond to emergency situations, and perform other daily tasks safely and without fatigue (e.g., house and yard work)," they have functional fitness (Corbin & Le Masurier, 2014). The ACSM notes the importance of functional fitness training, as well as exercising for good health, especially for older adults (ACSM, 2013). Developing and maintaining good health-related fitness is a priority for fitness education, but functional fitness is also important.

The focus in school physical education is on providing youth with the knowledge and skills they need to be active, fit, and healthy throughout life.

6. Health-related fitness test items for use in fitness education may differ from those used in research or for national surveillance. There is considerable interest among public health officials in tracking health-related fitness in youth, but this necessitates specific research designs and precise measures. For national surveys, such as those conducted between 1958 and 1985 (Morrow et al., 2009), only field test items supported by the most compelling evidence were selected.

The focus in school physical education is on providing youth with the knowledge and skills they need to be active, fit, and healthy throughout life. Therefore, the more important consideration in school fitness testing is whether items can help to evaluate personal fitness needs and facilitate fitness education. The items available in the FG battery were selected with this consideration in mind. The stated mission of FG (since inception) has been "to promote lifelong physical fitness, physical activity and other health-related behaviors" (Corbin & Pangrazi, 2008b, p. 1-4). Accordingly, the FG battery uses items that can be effectively administered in school settings and that have relevance for personal health, both during these formative years and later in life. The use of health-related fitness in daily life is an important educational consideration.

For national surveys, the IOM recommended the use of the PACER and submaximal treadmill or bicycle ergometer tests for cardiorespiratory endurance and BMI, waist circumference, and skinfold thickness (triceps and subscapular) for body composition. For use in fitness education, the PACER and the mile run for cardiorespiratory endurance and the BMI for body composition were recommended by the IOM (2012).

For muscle fitness hand-grip strength and the standing long jump were recommended (IOM, 2012). These items were chosen for use in national surveys and are considered appropriate for use in educational testing because of the evidence linking them to health markers and because of their relatively high association to more sophisticated measures of musculoskeletal fitness. Although the evidence was not as strong as for items chosen for a national survey, the curl-up, push-up, and sit-and-reach were deemed appropriate for use in fitness education programs. Although not addressed by the IOM report, a trunk extension test is used in the FG battery. This item is included in FG to help teach students about the importance of lower-back strength and endurance (core muscle fitness) for functional fitness and reducing the risk of back pain later in life (Plowman, 1992). Evidence to date has not supported the utility of this item for detecting risk of back pain among youth; however, it is still a useful item in fitness education.

7. Cardiorespiratory endurance is the recommended term for the fitness component frequently described as cardiovascular fitness, aerobic fitness, cardiorespiratory fitness, or cardiovascular endurance. Numerous terms are used to describe the component of fitness associated with functioning of the cardiovascular, respiratory, and muscular systems. However, there are subtle differences in meaning and interpretation among these different terms. For field measures, the IOM (2012) recommends the definition by Saltin (1973); cardiorespiratory endurance is "the ability to perform large-muscle, whole body exercise at a moderate to high intensity for extended periods of time" (IOM, 2012, p. 1-2). The term *cardiorespiratory endurance*, and its definition, is appropriate for use in fitness education because it reflects the ability of a person to perform functional fitness activities of daily life associated with the three principal systems supporting performance (cardiovascular, respiratory, muscular).

Performance on the commonly used PACER test, for example, reflects cardiorespiratory endurance since it directly relates to the ability to sustain aerobic activity over an extended period. Lap scores on the PACER provide baseline information for both health information (where you stand in terms of health) and functional information (how much you can do and if you are getting better) and are useful in personal program planning. Lap scores can also be converted to estimates of aerobic capacity (see Concept 8), but the raw lap scores provide unique meaning about functional fitness. The mile run test also can reflect cardiorespiratory endurance, but it is not as widely used (or endorsed) due to the issues with motivation and pacing. The walk test, a test option offered in FG, provides an alternative assessment of cardiorespiratory endurance that has particular utility for youth with low fitness, special needs, and those who are just beginning physical activity.

8. An understanding of the term aerobic capacity is important for fitness education. Aerobic capacity reflects the maximal amount of oxygen that can be taken in and used by the body. It is typically expressed as maximal oxygen uptake ($\dot{V}O_2$ max) and $\dot{V}O_2$max is

generally considered to be the best measure of aerobic capacity. Because differences in body size can influence oxygen uptake (i.e., bigger people have more body tissue and use more oxygen), the measure of aerobic capacity is most commonly expressed relative to body weight (Cureton & Plowman, 2008, p. 9-3) or milliliters O_2 consumed per kilogram of body weight per minute (ml/kg/min or $mL/kg^{-1}/min^{-1}$).

While cardiorespiratory endurance and aerobic capacity are commonly considered to be synonyms, for educational purposes it is appropriate to differentiate between the two. Cardiorespiratory endurance is measured by field tests and reflects both health and functional fitness. Aerobic capacity, in contrast, reflects the overall capacity of the cardiovascular and respiratory systems, but not necessarily functional fitness. It is appropriate for youth to learn to convert field test scores to aerobic capacity scores and to understand the meaning of the term *aerobic capacity* since this indicator is often used to reflect health status in clinical and public health applications.


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9. Fitness components classified as health-related are also critical to performance in a variety of sports and other activities. The components of physical fitness are typically classified as either health-related or skill-related. As noted in Concept 3, health-related fitness components vary by age. A component considered to be skill-related in youth can be health-related later in life. The PYFP focuses on fitness components associated with health.

While health-related fitness is important primarily for health and functional fitness, it is important to note that the health-related components of fitness also play a significant role in physical performance, including performance in virtually all sports and games. For example, cardiorespiratory endurance is important for distance running and sports such as soccer and basketball; the various components of musculoskeletal fitness are important in sports such as volleyball, track and field, and football; flexibility is important in sports such as gymnastics and activities such as dance; and the composition of the body (lean versus fat mass) plays a role in many activities.

10. Power, formerly considered a skill-related fitness component, can also be considered a health-related component of physical fitness. The inclusion of power as a health-related component of physical fitness is supported by the recent IOM (2012) report. Power has traditionally been considered a skill-related component of fitness; however, it has also been referred to as a "combined" component (strength × speed) because of its association with strength (health-related) and speed (skill-related). The IOM noted that

> musculoskeletal fitness is a multidimensional construct that encompasses three related components: muscle strength (the ability of skeletal muscle to produce force under controlled conditions), muscle endurance (the ability of skeletal muscle to perform repeated contractions against a load), and muscle power (the peak force of a skeletal muscle multiplied by the velocity of the muscle contraction). (2012, p. S-7)

The committee concluded that "adequate experimental and prospective longitudinal evidence supports the relationship between the multidimensional construct of musculoskeletal fitness and health. Empirical evidence also is increasing for the importance of musculoskeletal fitness, especially muscle strength and power, to health outcomes in adults" (IOM, 2012, p. S-7). Finally, the IOM indicated that while further research is necessary, "growing evidence supports use of the handgrip strength test and the standing long jump as health-related musculoskeletal fitness test items in youth. Studies reviewed show a relationship between performance on these tests and bone health and body composition" (IOM, 2012, p. S-7).

The conclusions of the IOM are supported by recent research indicating that power and activities that build power are particularly associated with bone health in youth (IOM, 2012; Gunter, Almsteadt, & Janz, 2012). The ACSM notes that among adults, "the health benefits of enhancing muscular fitness (i.e., the functional parameters of muscle strength, endurance and power) are well established" (ACSM, 2013, p. 190). Furthermore, the ACSM indicates that insufficient power has been associated with health risks among older adults (ACSM, 2013).

Power (like musculoskeletal fitness in general) is specific for different muscle groups. However, it is often evaluated using vertical jump tests or the standing long jump. The IOM has recommended the standing long jump for use in national youth fitness surveys based largely on evidence from Europe, where it has been routinely assessed as part of the ALPHA Health-Related Fitness Test Battery (ALPHA-FIT, 2009). The FG program does not currently include assessments of power, but options may be available in future versions of the test battery. Fitness education programs should reflect the change in classification of power and provide instruction concerning activities that build power both in youth and later in life.

Summary

The goal of this article was to provide physical educators and health professionals with new and relevant information about physical fitness — particularly the impact of using one national health-related fitness assessment for youth across the United States. The 10 concepts reflect ideas and information relevant to the future of fitness education and fitness assessment. The first two concepts highligh the importance of fitness education and fitness assessment

within physical education. These concepts provide support for the new cooperative PYFP and PB efforts that provide program training. Concepts 3 and 4 document the relationship between health and fitness that is central to PYFP and fitness education programs. Concept 5 identifies functional fitness as a factor of increasing importance among health and medical professions and one that is worthy of consideration in fitness education. Concept 6 reconciles differences in test items among different tests designed for different purposes. Concepts 7 and 8 make a distinction between cardiorespiratory endurance (as measured by functional field tests) and aerobic capacity (as measured by lab tests) that may be useful in standardizing terminology in fitness education and educational fitness testing. Concept 9 makes the point that health-related fitness components also have performance benefits, which can be meaningful to youth in fitness education settings. Concept 10 indicates that power, formerly considered a skill-related or "combined" component of fitness, has health benefits and can be considered a health-related fitness component in fitness education programs.

The concepts described in this article are important for physical education professionals, as well as for researchers and public health officials. Professors involved in teacher education programs should consider educating students about these key concepts to facilitate future integration into fitness education and fitness assessment programs. Public health officials can use the concepts to educate the public about the health benefits associated with good fitness.

These concepts represent key summary points that were viewed as essential for effective coordination of fitness programming. The joining together of many different organizations to provide one comprehensive program that emphasizes students' health ushers in a new era of cooperation (AAHPERD, 2013d). All cooperating groups share the common goal of "empowering kids to live active lifestyles" (AAHPERD, 2013d). But implementing program change takes time. Among those who develop tests (and related programs), factors such as gathering the needed evidence, approval of change by scientific advisors, preparation of new program materials, modification of computer programs, and modification of education training programs must be considered. For teachers who administer the tests (and related programs), it is important to embrace and stay abreast of change, seek training in new programs, and provide feedback to those who develop and implement programs.

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