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Conceptual Framework for the Brockport Physical Fitness Test

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In this manuscript, the conceptual framework for the Brockport Physical Fitness Test (BPFT) is presented. The framework provides the basis for the selection of test items and standards to assess health-related physical fitness of youngsters with disabilities. The framework defines and describes the relationships among health, physical activity, and health-related physical fitness and presents the process used for personalizing health-related criterion-referenced physical fitness testing and assessment for youngsters with disabilities.

Health, Physical Activity, and Health-Related Physical Fitness

The BPFT is a criterion-referenced test of health-related fitness. In a criterion-referenced approach, test scores obtained by youngsters are compared to standards that are thought to be associated with some index of positive health. It is important that test users understand the bases for these standards when assessing a youngster's performance.

The framework for developing the BPFT is represented by Figure 1. This schematic, which is modified from a model described by Bouchard and Shephard (1994), helps to understand how and why test items and standards on the BPFT were selected. In this conceptual framework, health that impacts or relates to physical activity provides the basis for indices and criteria for the evaluation of physical fitness. Health-related fitness includes components and standards of fitness that are affected by habitual physical activity and relate to health status. Physical activity provides a conditioning benefit for the development and maintenance of health-related physical fitness and provides health benefits of its own. Clearly health, health-related physical fitness, and physical activity affect and are affected by each other. Relationships among physical activity, health-related physical fitness, and health depicted in the paradigm are discussed in greater detail in the following paragraphs.

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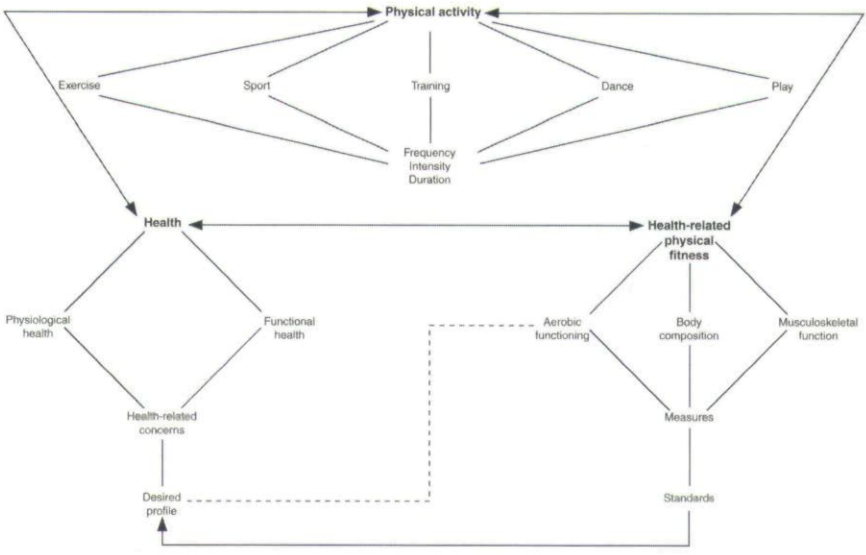

Figure 1—Relationships among health, physical activity, and health-related physical fitness. From *The Brockport Physical Fitness Test Manual*, p. 10, by J. Winnick and F. Short, 1999. Champaign, IL: Human Kinetics. Reprinted with permission.

Health

Health is defined as a "human condition with physical, social, and psychological dimensions, each characterized on a continuum with positive and negative poles. Positive health is associated with a capacity to enjoy life and to withstand challenges; it is not merely the absence of disease. Negative health is associated with morbidity and, in the extreme, with premature mortality" (Bouchard & Shephard, 1994, p. 84). In the Brockport paradigm, health is conceived of consisting of two general constructs, *physiological health* and *functional health. Physiological health* is related to the organic well-being of the individual. Indices of physiological health include traits or capacities that are associated with well-being, absence of a disease or condition, or low risk of developing a disease or a condition. Appropriate levels of body composition and aerobic capacity are examples of indices of good physiological health.

Functional health is related to the physical capability of the individual. Indices of functional health include the ability to perform important tasks independently and the ability to independently sustain the performance of those tasks. Ability to perform activities of daily living (ADLs), ability to sustain physical activity, and ability to participate in leisure activities are examples of indices of good functional health. Both physiological health and functional health contribute to one's capacity to enjoy life and to withstand challenges; both provide indices of health that serve as the bases for health-related physical fitness standards.

Health Related Physical Fitness

The Brockport definition of health-related physical fitness is as follows:

> Health-related fitness refers to those components of fitness that are affected by habitual physical activity and relate to health status. It is defined as a state characterized by (a) an ability to perform and sustain daily activities and (b) demonstration of traits or capacities that are associated with a low risk of premature development of diseases and conditions related to movement. (modified from Pate, 1988)

The health-related components of fitness adopted for this test include *aerobic functioning*, *body composition*, and *musculoskeletal functioning*. *Aerobic functioning* is a term that encompasses both aerobic capacity (maximum oxygen uptake) and aerobic behavior (the ability to perform aerobic activity at specified levels of intensity and duration). *Body composition* provides an indication of the degree of leanness/fatness of the body (usually, percent body fat). *Musculoskeletal functioning* is a component that combines measures of muscular strength, muscular endurance, and flexibility/range of motion. Combining these elements speaks to their relationship especially when programming. The Brockport definition of health-related physical fitness is consistent with the definition of physical fitness advanced by Caspersen, Powell, and Christenson (1985). These authors indicate that physical fitness is a set of attributes that people have or achieve that relate to the ability to perform physical activity.

Physical Activity

Physical activity consists of any bodily movement produced by skeletal muscle resulting in a substantial increase over resting energy expenditure (Bouchard & Shephard, 1994). Although categories of physical activity can also include work and domestic chores (Shephard, 1994), the Brockport approach focuses on those categories that more directly relate to physical education and leisure time activity, exercise, sport, training, dance, and play. These types of physical activity can be performed in different "patterns" as dictated by frequency, intensity, and duration variables. In the Brockport approach, the primary role of physical activity is related to the conditioning benefit it provides in developing health-related physical fitness.

The Personalized Approach for Test Development and Assessment

Field based norm-referenced or criterion-referenced tests of physical fitness, which have been developed and used with youngsters in the past few years, have exhibited several identifiable characteristics. Important here is that they have been developed to a great extent on an assumed commonality regarding factors such as physical fitness purposes, needs, test items, and standards. Typically, individualization within tests has been limited to and focused upon age and gender considerations. Thus,

tests which have been developed have typically consisted of a standard number of test items, which are performed in a specific way and are evaluated using a general population standard. Also, tests usually have been developed *for* youngsters rather than *with* youngsters.

Although some tests clearly have value for the typical hypothetical youngster, they also clearly have limited value for youngsters with disabilities. In regard to health-related tests of physical fitness, health-related concerns of youngsters with disabilities often exceed, as well as differ, from youngsters in the general population. Specific disabilities may affect movement modes, movement abilities, and health-related physical fitness potential. For example, individuals completely paralyzed in the lower extremities using a wheelchair are unable to demonstrate aerobic functioning by *running* a mile. A different way of demonstrating and assessing aerobic functioning is necessary in such an instance. An individual with double leg amputation at or near the hip-joint will require different maximum oxygen intake or body mass index standards to validly evaluate fitness than will peers without disabilities. Perhaps test items to measure physical fitness should be different for youngsters with these disabilities. Perhaps health-related concerns and subcomponents of physical fitness need to be modified or be different than those selected for individuals without disabilities. Because of the wide variation in needs and abilities of youngsters with disabilities, the specific nature of a physical fitness test should be developed with personal association and interaction with youngsters being served to the extent possible. When this occurs, the test becomes *personalized* as well as individualized. These concepts have not traditionally played an important role in the development of physical fitness tests.

Because of the many problems cited above, the BPFT has incorporated a personalized approach regarding physical fitness testing and assessment (Winnick & Short, 1999). Following development of an orientation to health-related criterion-referenced physical fitness and a corresponding definition of physical fitness, the following steps, which are discussed in subsequent paragraphs, are suggested for developing a health-related, criterion-referenced physical fitness test.

- Identify and select health-related concerns of importance to the youngster.
- Establish a desired personalized fitness profile with (or for, as necessary) the youngster.
- Select components and subcomponents of physical fitness to be assessed.
- Select test items to measure selected fitness components and subcomponents.
- Select health-related criterion-referenced standards to evaluate physical fitness.

Health-Related Concerns

Following acceptance of a given orientation to health-related physical fitness, the first step in development of a personalized physical fitness test for a person or class of persons is to identify and select health-related concerns that have some connection to fitness. In practice, health concerns of the general population are reviewed to determine if they are appropriate for individuals with disabilities. These con-

cerns provide a point of departure for use of criterion-referenced standards where health status is used as the criterion. For example, the developers of Prudential FITNESSGRAM (FITNESSGRAM) identified health-related concerns related to that test. Health-related concerns associated with the FITNESSGRAM include high blood pressure, coronary heart disease, obesity, diabetes, some forms of cancer, lower back flexibility, functional health, and other health problems. These may also serve as the basic concerns of individuals with disabilities. However, individuals with disabilities may also have additional health-related concerns regarding their health status. For example, a youngster with a spinal cord injury requiring a wheelchair for ambulation may have health-related concerns typical of youngsters without disabilities. However, additional concerns for this individual may include the ability to propel a wheelchair manually, the need to enhance flexibility/range of motion of the hips and/or the upper body, sufficient strength and endurance to lift and transfer the body independently, or the ability to lift the body to prevent decubitus ulcers. Health-related concerns such as these may be drawn from professional literature, expert opinions, opinions of parents, youngsters themselves, or other sources deemed appropriate. The key is to identify and select health-related concerns most relevant and important to the individual.

Desired Personalized Profile

Once health-related concerns are identified, a desired personalized physical fitness profile is developed for a person or class of persons. A desired profile establishes the direction or broad goal for a health-related physical fitness program. A profile statement may be written that implicitly or explicitly identifies components of physical fitness that will be addressed and expresses underlying value of the component in regard to the health-related concerns. The profile, thus, serves as a reference for a personalized and/or desired state of physical fitness. If appropriate, the profile serves as a basis for selection of test items and standards for evaluation of health-related physical fitness. Desired profiles should, at least, reflect *minimal* acceptable levels of physical fitness; however, they may also reflect *preferred* levels. The following sentence reflects an example of a desired physical fitness profile for individuals with spinal cord injury:

> Individuals with spinal cord injury should, at minimum, possess a physical fitness profile that promotes levels of aerobic behavior and body composition consistent with positive health, levels of flexibility, and range of motion to perform activities of daily living and inhibit contractures, levels of muscular strength, and endurance of wheelchair users to lift and transfer the body and propel a wheelchair, muscular strength and endurance to counteract muscular weakness, and fitness levels needed to enhance the performance of daily living activities (including sport activities).

Components of Physical Fitness

Components of physical fitness associated with the BPFT include aerobic functioning, body composition, and musculoskeletal functioning. Each of these may include specific subcomponents or areas that may be selected for a personalized physical fitness test. For example, in regard to aerobic functioning,

aerobic capacity and/or aerobic behavior may be selected. Subcomponents of body composition may include percent body fat or the relationship of weight and height (body mass index). Musculoskeletal functioning may include components of muscular strength and/or muscular endurance and flexibility/range of motion. Components and more specific subcomponents to be included on a personalized test should be consistent and in accord with the desired profile associated with persons or classes of persons. The BPFT recommends that all three components of physical fitness be included in every personalized test of physical fitness to the extent appropriate.

Test Items, Validity, and Reliability

Once components and subcomponents of health-related physical fitness are selected in consideration of health-related concerns and profile statements, test items are selected to measure them. Validity, reliability, the extent of use for different classes of youngsters, the extent of information provided by a test item, economy of time and expense, user friendliness, and feasibility in field situations are among the criteria for the selection of test items.

A total of 27 test items are included in the BPFT. Selection guides are provided to help testers select those tests that might be most appropriate for a youngster with a particular disability. The large number of test items provides teachers with flexibility in attempting to *personalize* the test. In most cases teachers will select between 4 and 6 test items to be used with a particular student. In subsequent articles in this issue, more detailed information on the rationale for the selection of test items, validity, reliability, and attainability of standards is presented.

Essentially, three different types of validity are claimed for the various test items: concurrent, construct, and logical (or content). Where an item has concurrent validity, it has a relationship with some criterion measure of the component/subcomponent of fitness being measured (e.g., VO_{2max}, percent body fat). Where concurrent validity is claimed for BPFT test items, reported correlations between the test item and the criterion measure are considered to be at least moderate (most r's = .70 - .89).

Construct validity may be claimed when a test item "loads" with related items in a factor analysis; these related items statistically and logically define a "construct" (e.g., strength, body composition, etc.), and each item that helps to define a construct can be used to measure it. Construct validity is used to support, at least in part, several test items on the BPFT.

Logical validity is claimed for most of the items in the BPFT battery. In each case, a rationale exists for relating a test item to some important criterion behavior. Sometimes the rationale is anatomical (e.g., the curl-up test measures the strength/endurance of the abdominal muscles; the Thomas test measures the length of the hip flexors; the back saver sit and reach assesses the flexibility of the hamstrings) and other times it is functional (e.g., the wheelchair ramp test evaluates the ability to negotiate a one-step standard incline; the 40m push/walk tests the ability to achieve a "functional" speed for community mobility), but in each case, the test purports to measure an aspect of fitness with health-related implications. Whether established statistically or logically, evidence of validity is provided for each item in the BPFT.

A variety of statistics are used to demonstrate reliability on a test-retest basis. The interclass r (the Pearson product-moment coefficient), the intraclass R, and Cronbach's alpha (a) all have been used to estimate the reliability of test items in the BPFT. The intraclass R and Cronbach's alpha are preferred measures of reliability because they account for more sources of measurement error than does the interclass r. Proportion of agreement (P) is a reliability estimate of a criterion-referenced test and provides information on the consistency of pass/fail decisions over two administrations of the test. Generally speaking, reliability coefficients greater than .70 are considered minimally acceptable estimates of score consistency (Safrit & Wood, 1995). Values of .90 or higher usually are considered to indicate a high degree of reliability. However, to expect the reliability of all tests in physical education and exercise science to be .90 or above is not reasonable (Safrit & Wood, 1995). Test-retest reliability coefficients associated with BPFT test items generally reflect at least minimal levels of acceptability, and several are indicative of items that are highly reliable. Statistics on reliability are unavailable for six items in the battery. Scoring for these items, however, generally seems to be fairly objective, which should help to control that source of measurement error. Readers are referred to subsequent articles in this issue for more information on test item reliability.

Standards for Evaluating Physical Fitness

Types of Standards Once test items have been selected to measure components and subcomponents of physical fitness, standards are selected that serve as a basis for evaluating fitness with a health status orientation. In the BPFT, standards to assess physical fitness are expressed as either *general* or *specific*. A *general standard* is one that is associated with the general population. It is a test score that is related to either functional or physiological health and is attainable by youngsters whose performance is not significantly limited by impairment. A *specific standard* also reflects functional or physiological health, but it has been adjusted in some way to account for the effects of a specific impairment upon performance. General standards may be recommended for the general population or for youngsters with specific disabilities. Specific standards are only provided for selected test items for specific groups with a disability.

For *general* standards, teachers will typically have two levels of standards from which to choose, *minimal* and *preferred*. A *minimal general standard* is considered to be an acceptable score. It meets the lowest acceptable criterion of *health* associated with a particular test. Most youngsters should be able to attain the appropriate minimal general standard provided. A *preferred general standard* is meant to convey a higher level of fitness and is, therefore, more desirable. A *preferred general standard* represents a good level of fitness and is one that many youngsters will find challenging. In a few instances, a *single general standard* rather than a minimal or preferred general standard is recommended and provided. In such instances, the single standard is associated with a good or preferred level of fitness.

The Bases for Standards The key for the evaluation of health-related physical fitness is the development and application of appropriate standards. Testers need to know the bases for standards to accurately interpret the results of testing. In essence, the criterion-referenced standards for the evaluation of fitness on the BPFT

are based on two health constructs: physiological health and functional health. Physiological and functional health are enhanced by appropriate levels of aerobic functioning, body composition, and musculoskeletal functioning, i.e., components of health-related physical fitness. The key is to determine the level of fitness test performance associated with positive health. It is this level that represents the standard and that must be established and defended for every test item included in the test. For physiological health, these levels may relate to an individual's well-being, the absence of a disease or condition, or a low risk of developing a disease or condition. For functional health, the standard representing a level of fitness may relate to the performance of important tasks independently or to the sustenance of those tasks. For example, an acceptable level of aerobic capacity is one that reduces the risk of developing diseases and conditions in adulthood, including high-blood pressure, coronary heart disease, obesity, diabetes, and some forms of cancer. The level is a standard that may be represented or indicated by the individual's maximum oxygen uptake/kilogram. The actual value is determined via a number of strategies including logic, research, or expert opinion. The development of standards is a crucial feature for personalizing health-related physical fitness.

The last four articles in this issue present information that provides a rationale for levels of fitness or standards for each test item as well as a rationale for components and test items developed in connection with the BPFT. Each of the articles presents this rationale following an analysis and overview of the relationships among health, desired levels of fitness, test items, and standards.

Sources of Standards Standards that are recommended in connection with the BPFT come from a variety of sources. Several *general* standards appropriate for the general population and, at times, recommended for youngsters with disabilities are associated with the FITNESSGRAM (Cooper Institute for Aerobic Research, 1992). These include standards for the following items: VO_{2max}, one-mile run/walk, skinfold, percent body fat, body mass index, curl-up, trunk lift, push-up, pull-up, modified pull-up, flexed arm hang, back saver sit and reach, and shoulder stretch.

Standards for VO_{2max} and the one-mile run/walk appearing in the FITNESSGRAM were based upon procedures used and results attained by Cureton and Warren (1990), and standards for the 20m PACER were based on the work of Leger, Mercier, Gadoury, and Lambert (1988). Their use in FITNESSGRAM is described by Cureton (1994).

Standards related to body composition used in the FITNESSGRAM were developed as described by Lohman (1994). T.G. Lohman (personal communication, May, 1997) subsequently provided additional skinfold and body mass index values for the BPFT associated with minimal general standards and preferred general standards.

Standards associated with several musculoskeletal test items in the FITNESSGRAM were based on expert opinion following a review of normative data associated with nondisabled youngsters (Plowman & Corbin, 1994). These include the push-up, the pull-up, modified pull-up, flexed arm hang, trunk lift, curl-ups, shoulder stretch, and back saver sit and reach. Standards reflecting performance of the general population on items not associated with the FITNESSGRAM were developed on the basis of data collected on 913 youngsters from the Brockport Central School District (Brockport, New York). Minimal and preferred standards related to performance of the general population in connection with the dumbbell

press, 35-lb. bench press, extended arm hang, grip strength, and isometric push-up were based, in part, on these data. General standards for the Apley, Thomas, and Target Stretch Test (TST) were based on expert opinion (Advisory Committee, 1997). General standards for the Target Aerobic Movement Test also were based on expert opinion (Advisory Committee, 1997).

Specific standards were also based upon expert opinion, related literature, and data collected involving samples of youngsters with disabilities. Data collected as a part of Project Target were used to field-test suitability of test items, reliability, and attainability of standards on the 35-lb. bench press, extended arm hang, flexed arm hang, the curl-up (modified), grip strength, isometric push-up, seated push-up, reverse curl, 40m push/walk, modified Apley and Thomas tests, the 16m and 20m PACER, and the one-mile run/walk. Data associated with Project UNIQUE (Winnick & Short, 1985) were also consulted in selecting standards for the flexed arm hang, grip strength, and skinfold measures. Recommended specific standards for youngsters with mental retardation were developed following particular consultation of data provided by Eichstaedt, Polacek, Wang, and Dohrman (1991), Hayden (1964), and the Canada Fitness Award (Government of Canada Fitness and Amateur Sport, 1985). Standards associated with the TST are based on optimal levels of range of motion presented by Cole and Tobis (1990) and functional standards recommended by the Project Target Advisory Committee (Advisory Committee, 1997).

Personalization

Personalization plays an essential part in the conceptual framework for the BPFT. A major contribution of the BPFT is that it provides desired levels of fitness through profile statements (which may be seen in subsequent articles in this issue) related to the three components of health-related fitness: aerobic functioning, body composition, and musculoskeletal functioning for disabilities targeted by the BPFT. Targeted disabilities include mental retardation, visual impairments, spinal cord injury, cerebral palsy, and congenital anomalies and amputations. Test items and standards are recommended to fulfill profile statements associated with each of these targeted populations. The BPFT is developed on the assumption that teachers generally will select profiles, tests, and standards from those implicitly suggested in the test manual. However, the test provides a process that may be used when teachers decide to develop other profiles. Information in subsequent articles in this issue describe relationships among profile statements, fitness components, test items, and standards. This information supports the conceptual framework for the BPFT.

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