Considerations for Fitness Appraisal, Programming, and Counselling of People With Intellectual Disabilities

Christine Seidl

Catalogue Data

Although people with intellectual disabilities should prioritise healthy living and physical fitness, they often exercise less than nondisabled citizens (Canada Fitness Survey, 1986) and demonstrate lower measures of aerobic power, muscular strength and endurance, body composition, and flexibility (Fernhall & Tymeson, 1988; Reid et al., 1985; Rintala et al., 1992). Lavay et al. (1990) emphasised that a healthy lifestyle is at least as important for people with an intellectual disability as it is for the general population. People with intellectual disabilities need sound fitness assessment and programmes that address issues related to their intellectual and adaptive behavioural capabilities. In the last 15 years, adapted physical activity literature has emphasised health and physical fitness (e.g., McCubbin et al., 1991; Pitetti et al., 1993; Seidl et al., 1987), a trend that reflects the growing concerns about health and physical fitness of the general population.

DEFINITION AND CLASSIFICATION

Intellectual disability is the preferred term for the condition formerly called mental retardation. The Active Living Alliance for Canadians with a Disability has recommended person-first terminology. The Canadian Association for Community Living (CACL), the national umbrella association, has adopted the reference persons with an intellectual disability.

Previous definitions of intellectual disability or mental retardation have referred to three basic components: subaverage intellectual functioning, usually reflecting a standardised IQ test score ≤ 70; deficits in adaptive behaviour, gener-
ally referring to skill functioning; and manifestation of the condition within the developmental years (American Psychiatric Association, 1990; Grossman, 1983). More recently, the American Association on Mental Retardation (Luckasson et al., 1992) redefined the diagnostic criteria for intellectual disabilities, placing less emphasis on intellectual functioning level and broadening the adaptive behavioural component.

Mental retardation is characterised by significantly subaverage intellectual functioning existing concurrently with related limitations in two or more of the following adaptive skill areas: communication, self-care, home living, social skills, community use, self-direction, health and safety, functional academics, leisure, and work. Mental retardation usually manifests before age 18.

The most extensive modification to this definition is specification of the term *adaptive behaviour* into 10 skill areas, seven of which (self-care, home living, social skills, community use, self-direction, health and safety, and leisure) are indirectly, sometimes directly, related to motor behaviour and fitness. Although behaviours in these adaptive skill areas coexist, individuals demonstrate varying degrees of specific adaptive behaviour deficits. Likewise, people with intellectual disabilities need highly individualised degrees of support.

Approximately 3% of the population have intellectual disabilities (Grossman, 1983). According to the Canadian Association for Community Living (n.d.), an estimated 815,000 Canadians are intellectually disabled (CACL, n.d.). Grossman (1983) developed a four level classification system according to IQ level: profound, severe, moderate, and mild, corresponding to IQ scores <19, 20–35, 36–51, and 52–70, respectively. The majority of people with intellectual disabilities corresponded to higher levels of functioning (i.e., 90% mild, 5% moderate, 3.5% severe, and 1.5% profound). The new definition of intellectual disability deemphasises intellectual functioning and is further defined by four levels of required support: intermittent, limited, extensive, and pervasive. The Canadian Association for Community Living does not recognise IQ-specific classifications but supports the notion of intellectual disability. That is, functional classification should analyse a person’s intelligence as well as interactions with the environment and degree of support needed.

Most of the literature published prior to 1992 describes subjects according to the old definition of intellectual disability based on IQ. To expand this model, Table 1 contains a list of global characteristics (e.g., motor behaviour, communication, self-care, and academic potential) that are specific to various levels of retardation but in no way represent all people within each level.

Although this review adopts the more contemporary definition, classification terms, such as mild to moderate levels of functioning, are used, since they are still prevalent in the literature. However, this document will also make reference to Grossman’s (1983) classification system, since most studies about people with intellectual disabilities have used this method to define the subject population.

**ETIOLOGY AND MEDICAL CLASSIFICATION**

The etiology of intellectual disabilities fall into two basic categories: organic (known medical causes) and nonorganic (unknown or familial/environmental causes). Although intellectual disabilities have numerous causes, the majority of cases (75%)
### Table 1  Characteristics of Persons With Mental Retardation

<table>
<thead>
<tr>
<th>Level of Retardation</th>
<th>Characteristics</th>
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<tbody>
<tr>
<td>Mild</td>
<td>Retardation not often apparent until school difficulties arise</td>
</tr>
<tr>
<td></td>
<td>Minimal delay in motor development and motor skill acquisition</td>
</tr>
<tr>
<td></td>
<td>May learn academic skills up to grade 6</td>
</tr>
<tr>
<td></td>
<td>Learn social and vocational skills for self-support</td>
</tr>
<tr>
<td></td>
<td>May require assistance in difficult economic times</td>
</tr>
<tr>
<td>Moderate</td>
<td>Can learn to talk and communicate but at delayed rate</td>
</tr>
<tr>
<td></td>
<td>Motor deficits and coordination problems are common</td>
</tr>
<tr>
<td></td>
<td>May learn academic skills up to grade 2</td>
</tr>
<tr>
<td></td>
<td>Require specific training in social and vocational skills</td>
</tr>
<tr>
<td></td>
<td>Often require some supervision in adult living but may succeed in unskilled or semi-skilled work</td>
</tr>
<tr>
<td>Severe</td>
<td>Speech is minimal and delayed</td>
</tr>
<tr>
<td></td>
<td>Significant delay in motor development</td>
</tr>
<tr>
<td></td>
<td>Can be taught basic self-care skills</td>
</tr>
<tr>
<td></td>
<td>Will require supervision and support in most vocational pursuits and adult living</td>
</tr>
<tr>
<td>Profound</td>
<td>Speech may be absent</td>
</tr>
<tr>
<td></td>
<td>Significant delays in motor development</td>
</tr>
<tr>
<td></td>
<td>Physical abnormalities are common</td>
</tr>
<tr>
<td></td>
<td>Will require assistance in self-care skills</td>
</tr>
<tr>
<td></td>
<td>May require nursing-type care</td>
</tr>
</tbody>
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fall under nonorganic etiology (Sherrill, 1993). Among organic etiologies, prenatal causes, such as chromosomal anomalies (e.g., Down syndrome [DS], fragile X syndrome) and maternal substance abuse (e.g., fetal alcohol syndrome), comprise the most frequently occurring syndromes (Sherrill, 1993). Other causes include prenatal diseases (e.g., rubella), perinatal causes (e.g., brain trauma, anoxia) and postnatal diseases (e.g., encephalitis, meningitis) as well as psychosocial factors. Down syndrome is commonly separated from other causes of intellectual disability because of the associated visible characteristics, such as short stature and facial features. However, intellectual and adaptive behaviour functioning can vary widely among individuals with intellectual disabilities.

Fragile X syndrome is gaining considerable attention and is the largest hereditary condition accurately diagnosed in the 1980s (Chudley & Hagerman, 1987). More common in males, fragile X syndrome is characterised by distinctive cranial
features and severe behavioural difficulties. Fetal alcohol syndrome is the most commonly preventable cause of mental retardation (Osborn et al., 1993).

BACKGROUND AND HISTORY OF ADAPTED PHYSICAL ACTIVITY

Physical activity for people with intellectual disabilities evolved similarly to physical education programmes for the general population; that is, from a medical model toward an educational model. Sherrill (1993) chronicled the evolution of adapted physical activity from its beginnings as "medical gymnastics" or "corrective physical education" in the early 1900s. Clinical and rehabilitative approaches treated conditions associated with various disabilities but did little to teach individuals how to function more appropriately within the environment. Early educational models in the 1960s emphasised sensorimotor or perceptual-motor activity in an attempt to "correct" cognitive and sensory defects. Today, adapted physical activity is responding to a very different view of people with a disability. The specialised field of adapted physical activity is, among other things, concerned with promoting and understanding appropriate assessment and physical activity programming for all people with disabilities. Adapted physical activity practices currently attempt to offer a wide range of physical activities, sports, and fitness and de-emphasise conducting special activities in segregated environments.

PARTICIPATION IN PHYSICAL ACTIVITY

People with intellectual disabilities generally lead sedentary lifestyles unless some degree of support and encouragement is provided. A Canadian study found that persons with health problems or disabilities often exercise less than nondisabled peers (Canada Fitness Survey, 1986). The same study determined that disabled citizens make little use of existing community facilities. To improve fitness, a sedentary lifestyle must be changed.

Sport participation is usually encouraged by family, group home workers, or educators. Levisen and Reid (1991) found that youth with intellectual disabilities participated mainly with family, teachers, or leader companions, and that a sedentary lifestyle was more common with increasing age. In this same study, activity preferences were similar to those of the general population (e.g., walking, swimming, bicycling, jogging, running, and ice skating), regardless of age. While this finding would favourably support inclusion, factors separate from "physically" including disabled citizens in a setting must be considered as well. Inclusion requires developing activities in the community that welcome and involve people with intellectual disabilities.

Block (1992) recommended an "ecological" or "functional approach" to planning physical activity so that individuals with intellectual disabilities are successfully included in standard or integrated programmes. According to the functional approach, the individual interacts with the functional environment. A physical activity programme with an ecological reference would focus on an individual’s abilities and interests in relation to the skills needed to successfully function in a community-based setting.

Competitive alternatives are also available for people with intellectual disabilities. International organisations, such as Special Olympics, founded in 1968 by Eunice Kennedy Shriver, provide year-round training and competitive
opportunities for people with intellectual disabilities. Most extensively networked in the U.S., Special Olympic programmes also exist across Canada. 10 provinces and 2 territories have Special Olympic organisations, which train athletes with intellectual disabilities and provide opportunities for people to compete with individuals who have similar physical conditions. The programme is designed for individuals age 8 and older. Although months of training ultimately culminate in competition, Special Olympics has always emphasised participation and fulfilment over winning.

**Fitness Appraisal**

**GENERAL CONSIDERATIONS**

People with intellectual disabilities are becoming more visible in the community due to changes in residential, educational, and work settings, as well as a movement aimed at empowerment. The most common residential arrangement is the *community living facility*, or *group home*, usually housing 6 to 15 people and located in residential neighbourhoods, and supported by live-in staff (Hayden et al., 1992). People in this type of residence usually function with moderate to mild levels of disability, according to Grossman’s (1983) classification system. Alternatively, individuals require limited to intermittent support, according to Luckasson et al. (1992). However, the least restrictive placement service for adults with intellectual disabilities is the *supported living arrangement*. Individuals live in an apartment, along with 1 to 5 other people, in the general community, and receive frequent staff supervision. Functioning at a fairly high level on most adaptive skill areas is requisite.

As more people with intellectual disabilities move into community-based dwellings, exercise specialists will have increased contact with members of this disability group. Fitness leaders should be aware of appraisal considerations, develop appropriate programmes, and provide sound instruction and direction in fitness programming for people with intellectual disabilities.

The Canadian Physical Activity, Fitness, and Lifestyle Appraisal (CPAFLA) (Canadian Society for Exercise Physiology, 1997) provides test procedures and appraisal suggestions that are suitable for the general population. However, a few procedural modifications and specific counselling approaches will make this test appropriate for people with intellectual disabilities. Accepting intellectually disabled citizens into community life will facilitate a general understanding about the disability, which in turn may affect the fitness appraisal and programming process and subsequently enhance the quality of life for individuals with intellectual disabilities.

Modified prescreening, fitness testing, and counselling procedures will not work equally for all people with an intellectual disability. The variability of motor behaviour and functional characteristics is large. In particular, several factors must be considered in the counselling phase of fitness programming, including intellectual capabilities, motor abilities, personal preferences, living situation, support network, accessible community facilities, and specific medical concerns. Explaining appraisal components should be simple, and various communication aids can be useful. Visual aids should be simple, and concrete analogies meaningful to the individual. Activity preferences should be discussed and attempts made to incorporate them into programming. Functional, age-appropriate, community-based programming that incorporates individual choice making is recommended.
PRESCREENING

Fitness appraisal for people with intellectual disabilities requires prescreening procedures similar to those for the general population, but with special considerations regarding informed consent and medical concerns, particularly for conditions common among people with DS (e.g., ventricular septal defect with correction, and atlantoaxial joint instability). Furthermore, fitness appraisers should get to know a participant (e.g., motor experience and capabilities, behaviours, level of intellectual and adaptive skill functioning), which will help the testing situation. Establishing a rapport prior to testing is fundamental.

INFORMED CONSENT

Most people with intellectual disabilities participate in fitness testing and counseling services upon the encouragement of living arrangement support personnel. Individuals with intellectual disabilities are often unaware of the health benefits of exercise. However, individuals may know from past experience that physical activity participation is fun and can provide a medium for social contact. This is not to say that the exercise benefits cannot be learned. If individuals frequently participate in activity, they will become aware of the health benefits and develop increased stamina as a result.

Although the guidelines and process for obtaining informed consent in the CPAFLA (1997) are clear, fitness appraisers should understand the unique considerations for people with intellectual disabilities. First, individuals should understand how and why their fitness is being tested. Support personnel should explain procedures when a client does not fully understand medical questions and release forms. Rintala et al. (1992) developed a three-step familiarisation process to ensure that subjects in a proposed fitness study were properly informed. The process involves visiting a subject’s home to meet with the client and concludes with a videotape presentation of the test before going to the laboratory. Rintala et al.’s process enabled subjects to receive proper instructions and fully understand all expectations and tasks. A detailed description of the process is provided later in this article.

People with intellectual disabilities who are age 18 or older may legally sign consent forms unless the judicial system has ruled an individual “incompetent” (Reid et al., 1993). However, if the individual’s disability requires other adult support for daily living, fitness appraisers should obtain additional written permission from a parent or legal caregiver. Occasionally, a person with an intellectual disability may not consent to fitness testing. An individual may be afraid or uninterested. At times, caregivers sign consent forms and encourage the individual to participate in fitness programmes, but participants withdraw when they realise what is entailed. Fitness appraisers may also obtain consent and cooperation from an individual who then chooses to withdraw after testing has begun. These choices must be respected.

MEDICAL CONCERNS

People with intellectual disabilities, like the general population, who are beginning a fitness regimen should obtain medical clearance. The PAR-Q questionnaire (CPAFLA, 1997) presents some particular concerns that a fitness appraiser/
counsellor should consider before testing or prescribing an exercise programme for people with intellectual disabilities.

Musculoskeletal Problems. People with DS, like other individuals with congenital neurological disorders, will exhibit varying degrees of hypotonia and joint laxity (Sherrill, 1993). The exact cause of muscular hypotonia is unknown. Researchers have theorised that the condition may be a manifestation of uncontrolled muscle stiffness and recruitment (Block, 1991). Hypotonia can improve with maturity (but not to normal tone), particularly if the individual has been active during the developmental years (Block, 1991). Joint laxity, defined as laxity in five or more joints, is common in people with DS. Ligaments mainly affect the function of the foot but are also often seen in the knee, hip, and cervical spine, which is particular cause for concern. Individuals with joint laxity often have badly pronated or flat feet and differences in walking gait.

Atlantoaxial Instability and Down Syndrome. The most significant skeletal abnormality associated with DS is atlantoaxial instability (AAI). AAI results from increased laxity of the transverse ligaments between the atlas and axis of the cervical spine (Cooley & Graham, 1991) and is asymptomatic in 12–20% of people with DS. However, approximately 2% of people with DS have a more critical condition, known as symptomatic atlantoaxial subluxation. People with this serious condition experience pain and discomfort, muscle weakness in the neck, and difficulty in walking. Surgery is usually indicated. Recently, Pueschel (1990) reported that as many as 30% of youngsters with DS have “atlantooccipital” instability. Individuals with DS who are beginning a fitness programme should have a medically clear radiograph of the cervical spine. If results are positive, participants should not engage in physical activity that could cause neck injury, which could result in irreversible spinal cord damage (Pueschel, 1990). Any activity that involves pressure, hyperextension, or flexion of the neck, or high-risk conditions are contraindicated. Since 1983, a physician’s statement indicating the absence of this condition was a prerequisite to unrestricted participation in Special Olympic activity (Sherrill, 1993).

Obesity and Down Syndrome. Persons with DS are often overweight or obese (Block, 1991). Researchers have yet to determine whether obesity in individuals with DS is mainly associated with lifestyle (activity and eating habits) or depressed resting metabolic rates. Nonetheless, extra weight combined with joint laxity and poor muscle tone can complicate motor function. Seidl et al. (1989) found that motor coordination problems can confound results on a stepping test. Therefore, familiarising clients with a test item may be useful.

Cardiac Problems and Down Syndrome. Congenital heart disease affects 40–50% of people with DS (Block, 1991; Cooley & Graham, 1991), the most common problem being ventricular septal defect. Heart defects are generally treated early in life with surgery or medication. Some residual effects may be present after correction, with potential for reduced fitness capacity. Consulting a physician is important in these cases.

Epilepsy. Epilepsy is common in people with intellectual disabilities. Approximately 30% of persons with severe intellectual disabilities have seizures, compared to 3 out of 1000 nondisabled persons (Sherrill, 1993). Medication can control and, in most cases, effectively prevent seizures. Uncontrolled seizure activity may reoccur at times, and medications then need readjustment. People who take heavy medications may experience adverse side effects, such as reduced
coordination, poor reaction time, and drowsiness, all of which can affect activity participation. Exercise specialists should be aware of factors associated with seizure activity, including hyperventilation, hyperhydration, hypoglycemia, fatigue, and, in women, menstrual periods. Fitness appraisers should also have basic first aid training in first response treatment for tonic-clonic seizures. Caregivers and physician reports should clearly communicate whether seizures are well controlled or precautions should be taken.

Other Medical Conditions. Many organic etiologies are less prevalent but may arise on an incidental basis. Many causes are linked to unique physiological parameters (e.g., Costello syndrome, neurofibromatosis), which will affect fitness assessment and programming. The exercise specialist should consult with the physician to obtain pertinent information.

OTHER RECOMMENDATIONS FOR PRESCREENING

Teaching people with intellectual disabilities to perform a physical skill can require specialised instructional methods. One useful method is Task Analysis with teaching cues or prompts that can be faded as skill performance improves. Task analysis implies that a required task is broken down into a series of progressive prerequisite tasks. This method stems from Austin's (1978) teaching approach that instruction and practice must be specific and directly related to the desired outcome. For example, if a client is to step up and down a double-step apparatus described in the Canadian Physical Activity, Fitness, and Lifestyle Appraisal (CPAFLA, 1997) manual, appraisers should teach the specific stepping sequence in a series of smaller subtasks leading to the final outcome.

Prompts were used successfully in a fitness programme for adults employed in sheltered workshops (Reid et al., 1990). Visual, verbal, and physical cues were adapted from the response-promoting continuum developed by Watkinson and Wall (1982). For example, a fitness appraiser might provide a physical prompt by holding a subject's hand during practice with the stepping apparatus. However, this kind of assistance is not recommended during the actual stepping protocol, since this prompt could affect the work output. Therefore, physical prompts should be faded entirely or into something that will not affect measurements. Holding the hand can be faded. For example, lightly placing a hand on the subject's back can provide security without affecting workload.

Excluding physical prompts altogether is optimal. An accompanying verbal prompt would be "Step, step, up, step, step, down" or "Up, 2, 3, down, 2, 3" to the desired tempo of the workload. Verbal prompts are often necessary throughout the entire test. Without assistance, the individual may lose concentration or motivation, or simply forget the following physical element. Other participants may be able to perform the test without any assistance.

Some people prefer not to be touched and learn best with clear task demonstrations. For example, people with intellectual disabilities who have associated autistic features can display tactile defensiveness (an aversive reaction to being touched) or overselectivity (e.g., inappropriate attention both directed at being touched and taken away from the task). Performing the task alongside the client may best assist the that individual.

Realistically, fitness specialists cannot be familiar with all conditions and diagnoses associated with intellectual disabilities. Spending adequate time prior to
testing to establish rapport with the client and speak with caregivers or support staff will provide the fitness appraiser with useful information. While these pretest procedures may take some time, they will have worthwhile results.

The literature suggests that a familiarisation period is necessary before testing fitness levels of people with intellectual disabilities (Rintala et al., 1995; Reid et al., 1993; Seidl et al., 1987). Although familiarisation protocols have not been standardised, Rintala et al. (1995) recommended a minimum of two practice trials prior to laboratory testing, and at least one for field tests of cardiorespiratory fitness.

Rintala et al. (1992) established a three-stage familiarisation technique for laboratory treadmill testing. First, the investigators individually met with each subject and showed a videotape of the testing environment, equipment, and simulated test. Second, subjects visited the testing laboratory, met staff, and viewed testing equipment, which allowed researchers to establish rapport and answer questions. Subjects were allowed to try some of the equipment. Finally, a simulation of the formal test was conducted in the testing environment. Measurements were not taken, and formal test protocols were not followed, but subjects were taught the routine required for each test. This careful procedure enabled appraisers to properly inform subjects and provided time for participants to fully understand the task(s). This type of familiarisation can help improve reliability and validity of test results (Reid et al., 1993) and could be adapted to field tests in general.

**Fitness Evaluation**

An overview of studies investigating physical fitness and training programmes for people with intellectual disabilities summarised a global trend in fitness and health profiles of these particular clients. People with intellectual disabilities have poor cardiovascular fitness, demonstrate poor muscular strength and endurance, and have excessive body fat (Lavay et al., 1990; McCubbin et al., 1991; Pitetti et al., 1993).

The physical fitness benefits for people with intellectual disabilities are well argued and documented, but using field tests and laboratory measures has proven difficult, and the appropriate measuring technique for physical fitness remains controversial (Shephard, 1992). Lavay et al. (1990) stated, “this leaves professionals and scientists interested in the physical well being of this population with the dilemma of choosing appropriate measures and procedures” (p. 264) of assessment. Without valid and reliable tests that can be feasibly administered, proper assessment procedures and training programmes for people with intellectual disabilities cannot be developed (Lavay et al., 1990; Seidl et al., 1987). This section will review conventional and modified tests previously used to assess the fitness of people with intellectual disabilities.

**AEROBIC FITNESS**

Few aerobic fitness tests are valid or reliable for people with intellectual disabilities. However, researchers still question the true validity of many tests, since test validity (peak oxygen consumption during treadmill exercise) remains uncertain for individuals with intellectual disabilities (Shephard, 1990). A modified step test (Montgomery et al., 1992) and walking field test (Kittredge et al., 1994; McCubbin
et al., 1997; Rintala et al., 1992) have the most aerobic fitness merit, based on test-retest reliability, validity relative to a treadmill protocol, feasibility, ease of administration, familiarity of the testing exercise mode, and simple modifications to maximise test completion.

Two treadmill protocols have also been suggested for testing people with intellectual disabilities: Pitetti et al.'s (1993) procedure and the Bruce protocol used by Montgomery et al. (1992). Both procedures are recommended, based on success at bringing subjects to criterion-referenced maximal oxygen uptake, and the advantageous, easy walking speeds at the beginning of the test. All testing will require systematic familiarisation, modifications (usually performance cues or prompts), and external motivational strategies.

Motor development and performance are widely variable among people with intellectual disabilities. While people with higher functioning often compare to nondisabled peers' performance, many participate in cardiovascular testing with limited coordination and low aerobic capacity (Lavay et al., 1990). Maximum oxygen intake (VO$_2$ max) values of 25–28 ml/kg · min in young adults with intellectual disabilities (Fernhall & Tymeson, 1988; Schurrer et al., 1985) are much lower than expected. VO$_2$ max values ranging from 19.7 to 36.4 ml/kg · min were observed across five test protocols with moderately functioning adults, compared to 42.1–45.5 ml/kg · min for a control group (Montgomery et al., 1992). The group with moderate function demonstrated both inferior levels of aerobic fitness and significantly different VO$_2$ max values depending on the type of test.

Some standard protocols (e.g., treadmill, shuttle run, and cycle ergometer) provide initial workloads that may be too demanding or require skills that are too advanced or unfamiliar for some people with intellectual disabilities. Reid et al. (1985) and Seidl et al. (1989) observed problems with coordination and cadence adherence during stepping exercises while (Lavay et al., 1987) noticed difficulty following prescribed work bouts and protocols on cycle ergometers. Pacing and motivation are problematic in the shuttle run (Montgomery et al., 1992) and walk/run field tests (Cressler et al., 1988; Fernhall & Tymeson, 1988). However, Watkins and Koh (1988) observed that extensive pacing and motivational strategies improved endurance running completion rates among intellectually disabled youth.

Treadmill testing has its merits compared to other testing protocols, because speed is controllable. However, orientation and familiarisation are crucial. Some people cannot walk or run with a steady and comfortable gait without holding on to handrails or looking down at the belt, factors that can compromise protocol validity (Lavay et al., 1990). Rintala et al. (1995) recommended a walking protocol measuring VO$_2$ on the treadmill (with a minimum of two practice sessions) as the best criterion measure of cardiorespiratory fitness for adults with mild or moderate levels of intellectual disability.

Physical stature also influences aerobic power (Shephard, 1990). People with intellectual disabilities are often physically distinct, with a shorter stature than age-matched peers (Lavay et al., 1990). Differences in stature increase with severity of the disability or the etiology (e.g., DS). Sherrill (1993) associates a shuffling gait and poor posture with intellectual disabilities. Abnormal posture and gait affect the efficiency of movement patterns. In addition, prevailing obesity influences oxygen cost when the activity involves a substantial displacement of body mass.
Motivational problems can complicate cardiovascular fitness tests for people with intellectual disabilities (Fernhall et al., 1988; Montgomery et al., 1992; Reid et al., 1985). A client may stop the test before achieving target work-rates or criteria for maximal effort. People with intellectual disabilities may prefer not to exert themselves or may experience uncomfortable symptoms while exercising. Test protocols may be too abstract. Alternatively, task requirements may be too complex. Poor pacing, however, can exacerbate motivational problems. Conversely, systematic pacing systems can improve motivation and the likelihood of test completion (Watkinson & Koh, 1988). McCubbin et al. (1997) found that testing assistants who accompany, pace, and motivate subjects to complete a 1.5 km walking test are crucial to test validity. Some people with intellectual disabilities (e.g., DS) may have lower maximal heart rates, thus limiting cardiac output (Pitetti et al., 1993). However, more data are needed to validate this hypothesis.

Step Tests. Several studies have used a step test to evaluate the fitness of people with intellectual disabilities (Montgomery et al., 1988; Reid et al., 1985; Seidl et al., 1989). Reid et al. (1985) developed a modified step when subjects were unable to maintain the given tempo. Instructors taught subjects to step up and down a double step apparatus, as specified in the CPAFLA (1997). Prompting evened pacing, and the number of ascents was recorded rather than assumed for each test stage. Montgomery et al. (1992), who predicted the individual’s VO$_{\text{max}}$ based on the regression equation proposed by Côté et al. (1986), found the step test to be reliable ($r = 0.97$) across five trials, and recorded intraclass correlations of 0.72 with the VO$_{\text{max}}$ from the treadmill. Researchers recommended a modified step test over submaximal cycling and maximum shuttle run protocols for measuring aerobic fitness of young adults with intellectual disabilities, characterised as moderately disabled.

Most importantly, a step test is administratively feasible (Seidl et al., 1987). Stepping is a familiar exercise mode for people who have experience climbing stairs. However, poor coordination can complicate descending of the stairs backward (Seidl et al., 1989) or maintaining or increasing cadences as required by the CPAFLA. Montgomery et al. (1992) successfully used the following modifications of standard CPAFLA protocol: heart rates were measured during the last 10 s of exercise using a Sport Tester device, rather than the first 10 s postexercise; and a regression prediction equation was based on actual number of steps climbed in the final test stage. Montgomery et al. (1988) and Seidl et al. (1989) recommended extensive preparation and familiarisation prior to step testing. Lavay et al. (1990) also suggested a nondisabled partner should step with the individual during testing, giving physical and verbal prompts to maintain cadence.

Walk-Run Field Tests. The 2.4-km run (Fernhall & Tymeson, 1988) and the Rockport Fitness Walking Test, or RFWT (Rintala et al., 1992), which predict aerobic fitness, have been validated for people with intellectual disabilities. The Cooper 12-minute run/walk was determined reliable for people with intellectual disabilities but was not validated (Cressler et al., 1988). Fernhall & Tymeson (1988) used bivariate regression analysis to develop a prediction equation for VO$_{\text{max}}$ from the 2.4-km run time. Intraclass correlation between VO$_{\text{max}}$ measured on a treadmill walking protocol and the 2.4-km run was –0.88. The formula was developed studying young adults, primarily female and classified at mild to moderate disability levels. Rintala et al. (1992) developed an equation for predicting VO$_{\text{max}}$
in male subjects with intellectual disabilities. The intraclass correlations varied between 0.78 and 0.83, and the test-retest reliability for the RFWT was 0.97. The RFWT was determined a valid and reliable indicator of aerobic fitness for young adult males functioning at moderate to mild levels of intellectual disability.

Rintala et al. (1997) conducted a cross-validation study based on the prediction equation previously developed (Rintala et al., 1992) for individuals with intellectual disabilities. The researchers had concluded that the RFWT was reliable \( r = 0.96 \) in these subjects. However, Rintala et al. (1997) questioned the validity of the equation because results indicated that the prediction equation underestimated the \( \text{VO}_{2\text{max}} \) values in 74% and 79% of subjects in two respective trials. Although the more recent study attempted to match the subjects with the earlier study, descriptive statistics showed that male subjects’ IQ, height, and weight were greater in the latter study. Subject selection appears to be a shortcoming in both studies. That is, sample sizes were small, only males were tested, and subjects in the latter study demonstrated above-average fitness levels.

Kittredge et al. (1994) investigated whether the generalised equations created for the RFWT were valid for adults with intellectual disabilities. Kittredge et al.’s study used both males and females with widely ranging intellectual disabilities (mild to moderate). Reseachers determined that RFWT was a reliable field test \( r = 0.87, p < .01 \) for absolute and relative measured peak \( \text{VO}_{2} \), with estimated peak \( \text{VO}_{2} \). However, the prediction equations developed for the RFWT (see Kline et al., 1987) cannot be used to predict cardiorespiratory fitness for people with intellectual disabilities, since these equations consistently overestimated the subjects fitness levels. Kittredge et al. (1994) recommended including a minimum of two trials for adults with intellectual disabilities using a 40-s criterion (i.e., both walk times are within 40 s or third walk trial is needed).

In contrast, McCubbin et al. (1997) found RFWT to be reliable \( r = –0.84 \), and the test did not over- or underestimate aerobic performance of male subjects with mild levels of disability. An accepted level of validity (71% of the variance was explained) was determined for the RFWT. However, researchers acknowledged that the narrow subject pool limits generalising these results.

When implementing the RFWT, maintaining a high level of subject motivation is essential to obtaining valid test results for people with intellectual disabilities (Kittredge et al., 1994; McCubbin et al., 1997; Rintala et al., 1992). In all instances, subjects were accompanied by walking partners who provided continual encouragement. Various types of meaningful rewards were used. Researchers recognise that reward systems are not always practical when conducting tests, and therefore, walking partners remain crucial for obtaining valid and reliable test results among people with intellectual disabilities.

In summary, the RFWT is recommended over the 2.4-km run used by Fernhall and Tymeson (1988) because walking 1.6 km is easier and more compatible with subjects who cannot or prefer not to run, and fitness appraisers can more easily motivate subjects to walk fast than run. Like the step test (CPAFLA, 1997), walking field tests are administratively feasible and a familiar activity for people with intellectual disabilities. Walking exercise is also commonly prescribed, because it is functional and can be generalised outside the fitness programme. The specificity of the test mode to exercise training may also be advantageous for walking field tests. While motivation remains a problem, constant pacing provided by test assistants is crucial to test success. Furthermore, test validity is limited to the narrow
range of subjects tested. Kittredge et al. (1994) recommended that further research aim to create generalised equations for a larger sample of adults with intellectual disabilities. Furthermore, these equations should be cross-validated to determine stability.

*The Modified Leger and Lambert (1982) Shuttle Run.* Montgomery et al. (1992) validated a modified maximal shuttle run against a modified maximal treadmill test and obtained an intraclass correlation of 0.90. Although significant, reliability was low (r = 0.78), and the shuttle run underestimated the actual peak VO₂ scores. Researchers found that the first-stage speed (8.5 km/h) for running along a 20-m distance was too fast and thus lowered the starting pace to 7 km/hr. The pace was then systematically increased by 0.5 km/hr every minute. The starting speed modification added 3 min of exercise before the first-stage level in the test protocol. Motivation and pacing were difficult in the shuttle run test. Most subjects terminated the test in under 3 min, despite modifications. Pacing and cadence adherence were difficult for the moderately disabled subjects in this study. Test termination may have related to poor pacing and motivational problems, rather than lack of physical fitness. The shuttle run test is stopped when a subject falls behind the pace. This speed is entered in to the regression equation to estimate VO₂ max.

*Cycle Ergometer Tests.* Some people with intellectual disabilities have recreational experience riding a bicycle or fitness training on stationary cycles. Therefore, testing aerobic capacity using cycle ergometry may be appropriate. However, clients are unlikely familiar with specific testing protocols and may tire quickly due to the predominance of quadricep muscle involvement in this test exercise (Lavay et al., 1987). The incremental Åstrand cycle ergometer test used with moderately disabled subjects in Montgomery et al.'s (1992) study was invalid, although participants showed a less marked fitness deficit in this test compared to the step or shuttle run test. Test duration was shorter for disabled subjects compared to a control group, and peak aerobic power was ostensibly overpredicted.

Cressler et al. (1988) obtained low reliability for a modified Physical Work Capacity (PWC) cycle ergometer test with adults, mostly male and functioning at moderate levels of intellectual disability. Although extensive modifications were used (e.g., prerecorded cassette tape, and visual and physical prompts), subjects still had difficulty maintaining prescribed cadences. The length of work stages (6-min intervals) may have been a factor.

McCubbin et al. (1997) examined a friction-braked cycle ergometer as a method to estimate cardiorespiratory fitness of men with mild intellectual disabilities. A submaximal Åstrand-Ryhming test was compared to peak VO₂ on the treadmill using an incremental walking protocol. Rintala et al.'s (1992) three-stage familiarisation process was used to increase subjects' comprehension of testing requirements and procedures. A significant correlation coefficient was obtained for the cycle ergometer test (r = 0.64), explaining 41% of variance between the two test methods, which was determined an acceptable level of validity for the cycle test.

However, the RFWT described earlier proved a better alternative for estimating peak VO₂ in subjects with an intellectual disability. McCubbin et al. acknowledged that the cycle test was harder to administer, since many subjects experienced difficulty adhering to cadence and handling workload changes. In addition, more practice was needed in the familiarisation stage prior to testing.
Overall, testing took more time and effort compared to RFWT. These difficulties, as well as the lower correlation results, suggested that, although valid, the submaximal Astrand-Ryhming cycle test is not feasible for predicting the aerobic performance of male adults with intellectual disabilities.

The Schwinn Air-Dyne Ergometer. The Schwinn Air-Dyne ergometer (SAE) is an air-braked mechanism that combines leg (pedalling) and arm (push/pull) movements. Pitetti et al. (1993) reported successful use of this apparatus by young adults with moderate intellectual disabilities. The test protocol used in this investigation demonstrated a regression coefficient of 0.90 against treadmill testing, this representing 82% of common variance. However, Pitetti et al. cautioned that the protocol was accurate only if subjects maintained a constant work level during each test interval. Verbal prompts helped subjects focus on keeping the indicator needle (a visual cue) at the proper work level. Subjects were young adults functioning at the moderate range of intellectual disability. Pitetti et al. (1988) reported that the same protocol overestimated VO$_\text{max}$ by more than 30% for individuals with DS. Pitetti et al. (1993) did not consider SAE to be a difficult exercise test. Although coordination problems were common, subjects tested using SAE were able to coordinate upper and lower body movements. Researchers suggested that SAE be used particularly when evaluating people who have gait impairments or poor coordination. Further research should aim to investigate the success of SAE protocols on a wider range of subjects with intellectual disabilities.

Treadmill Tests. The majority of studies using treadmill tests for people with intellectual disabilities have used various protocols and procedures standardised for the general population, including the Balke Ware Treadmill Test (Cressler et al., 1988; Temporowski & Ellis, 1984), the Modified Balke Ware Treadmill Test (Fernhall & Tymeson, 1987, 1988), the Bruce protocol (Montgomery et al., 1992), a Modified Balke protocol (Kittredge et al., 1994), and a modification of the protocol used by Fernhall and Tymeson (McCubbin et al., 1997; Rintala et al., 1992; Rintala et al., 1997). Although most of these studies reported low aerobic fitness for people with intellectual disabilities, discrepancies existed between the nature of reported maximal VO$_\text{max}$ values. Some studies report peak VO$_\text{2}$ (volitional exhaustion, or the highest minute value obtained during a test), whereas others report true VO$_\text{2, max}$ values where specific criteria (i.e., RER > 1.10 or heart rate plateau at more than 85% of the age-predicted maximum) indicate the subject has reached maximum physiological capacity. Rintala et al. (1995) suggest a plateau in the VO$_\text{2}$ time course. Volitional exhaustion may be questionable if no other VO$_\text{2, max}$ criteria have been reached, since motivation is a significant factor when testing people with intellectual disabilities.

Fernhall and Tymeson (1988) first used VO$_\text{2, max}$ results from a treadmill protocol to validate the 2.4-km run field test for people with intellectual disabilities. Investigators had subjects walk at a constant speed of 4.8 km/hr, starting at a 0% grade and increasing by 2.5% every minute until exhaustion. A modification of this protocol used by Rintala et al. (1997) and McCubbin et al. (1997) requires subjects to start walking at 3.9–6.2 km/hr for 2 min, depending upon the subject’s capabilities, starting at a 0% grade and increasing by 2.5% increments every 2 min until subjects reach and remain at a 20% grade, at which point speed is increased every minute until exhaustion.

Montgomery et al. (1992) validated three prediction tests (i.e., shuttle run, bench stepping, and cycle ergometer) by comparing results to peak VO$_\text{2}$ scores on
the treadmill using the Bruce protocol. This protocol involved speed and grade increments every 3 min, starting at a 10% grade and speed of 2.7 km/hr. The test continued with combined grade and speed increments of 2% and 1.3 km/hr, respectively, until exhaustion.

Because individuals with intellectual disabilities have low aerobic fitness and an unfamiliarity with treadmill walking or running, fitness appraisers should select protocols with a low oxygen cost during initial stages. People with intellectual disabilities can then establish a comfortable gait before workloads are increased. Tomporowski and Ellis (1984) used a protocol similar to Fernhall and Tymeson (1987), although reliability was not established. Subjects’ functioning levels were classified at the severe to profound level of disability (Tomporowski and Ellis, 1984). More research should aim to substantiate the reliability of a maximal treadmill protocol across a wide range of functional and intellectual levels.

Pitetti et al. (1993) recommended a treadmill protocol for evaluating the aerobic fitness of people with intellectual disabilities and suggested establishing initial walking speed on the treadmill during the practice session. Since walking speed differs among individuals, each test participant should select a personal level that is safe and easily handled. Selecting a work-rate at the start of the test that is too difficult can result in early test termination caused by trepidation rather than fatigue. The recommended protocol uses a standard incremental procedure but allows for a wide range of starting speeds based on the individual’s capabilities. Three walking protocols are summarised in Table 2.

Treadmill testing, although widely accepted as a means of measuring aerobic power in the general population (DeVries, 1986), requires expensive equipment and laboratory facilities. Moreover, treadmills can be intimidating to people with intellectual disabilities. Although walking is a familiar exercise for most people, walking on a moving belt and at increments of grade and speed is generally a new experience. Thus, familiarity refers to both exercise mode and characteristics. Maximal treadmill testing requires the treadmill, headgear, a mouthpiece, and a heart rate monitor as well as the skills for mounting and dismounting the moving belt. Fitness appraisers should provide subjects with ample time to learn these skills prior to testing.

Fitness appraisers, in preparation for evaluating the aerobic capacity of people with intellectual disabilities, should consider the following recommendations (Fernhall and Tymeson, 1987):

1. Familiarize the subject with the laboratory.
2. Allow ample training time prior to testing.
3. Provide adequate safety features so that participants do not risk or fear falling.
4. Tailor the protocol to the subjects.
5. Provide a comfortable and dignifying testing environment.

Modifying existing protocols or creating one treadmill protocol for evaluating the aerobic fitness of people with intellectual disabilities is quite recent. Further studies should focus on different age groups and various levels of intellectual and functional abilities.

Rintala et al. (1995) offered the most important information about preparing adults with intellectual disabilities for treadmill exercise. Subject familiarisation and motivational strategies are crucial. If stringent physiological criteria are used
Table 2  Recommended Treadmill Protocols for Evaluating Cardiovascular Fitness of Adults With Intellectual Disabilities in a Laboratory Setting

<table>
<thead>
<tr>
<th></th>
<th>Pitetti et al.</th>
<th>Montgomery et al.</th>
<th>Rintala et al.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treadmill speed</td>
<td>Between 3.2 and</td>
<td>2.7 km/hr (1.7 m</td>
<td>3.9–6.2 km/h</td>
</tr>
<tr>
<td></td>
<td>5.6 km/hr</td>
<td>ph)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.0 and 3.5 mph)</td>
<td></td>
<td>(2.5–4 mph)</td>
</tr>
<tr>
<td>Starting grade</td>
<td>0%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>Incremental</td>
<td>2.5%</td>
<td>2%</td>
<td>2.5% (20% max)</td>
</tr>
<tr>
<td>grade increases</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incremental</td>
<td>0</td>
<td>1.3 km/hr (0.8 mph)</td>
<td>0 (until 20% grade)</td>
</tr>
<tr>
<td>speed increases</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time intervals</td>
<td>2 min first 2 levels, 1 min. work levels (if blood pressure not monitored) 2 min. for all levels, BP at 1 min. (if blood pressure is monitored)</td>
<td>Every 3 min for both grade and speed</td>
<td>2 min., then 1 min. work levels</td>
</tr>
<tr>
<td>Main advantage:</td>
<td>Variety of treadmill speeds allows for individualization</td>
<td>Initial stage has low oxygen cost and can be completed by wide</td>
<td>Variety of treadmill speeds and familiarization process</td>
</tr>
<tr>
<td>Main difficulty:</td>
<td>Motivation to maximum</td>
<td>Motivation to maximum</td>
<td>Motivation to maximum</td>
</tr>
</tbody>
</table>

for identifying maximal effort, differences in the treadmill protocol selected are less important. However, protocol selection should be based on subjects’ capabilities. Walking, rather than running, protocols have more merit for people with intellectual disabilities. Subject familiarisation procedures should be used to increase comprehension and competence and reduce anxiety.

MUSCULAR STRENGTH AND ENDURANCE

Strength measurements are complicated by similar problems faced when estimating aerobic power, particularly motivation to exert maximal force. The CPAFLA handgrip dynamometer is a simple field test that requires one small, transportable piece of equipment and offers a high degree of test/retest reliability (Montgomery et al., 1988; Pitetti et al., 1988; Reid et al., 1985).

Early comparative studies (e.g. Coleman et al., 1976; Rarick et al., 1970) investigated muscular strength, power, and endurance in children with intellectual disabilities. Performance was lower among test subjects than among age-matched peers. However, most of these studies used indirect measurements, such as the
softball throw, standing long jump, flexed arm hang, or pull-ups. The validity of these test items is particularly questionable when used with children with intellectual disabilities, due to the degree of motor skill required. Motor skill development is generally slower for children with intellectual disabilities than for nondisabled youth. Skill development, although it can improve, remains delayed throughout the developmental years (Sherrill, 1993), especially in terms of balance and visual-motor coordination. These study results should be interpreted with caution from a fitness perspective, as scores were probably more reflective of poor motor performance than lack of strength. Shephard (1990) also cautioned that poor motor performance may reflect the shorter stature of children with intellectual disabilities.

Recent studies on adults with intellectual disabilities use conventional measures of muscular strength and endurance. Motivation is a problem with direct strength measurements. Achieving maximal effort is difficult when testing the cardiovascular fitness of individuals with intellectual disabilities and remains ambiguous when testing other fitness parameters, such as muscular strength and endurance.

Field Tests. Manual muscle testing has been used in various clinical and rehabilitation settings to assess strength and determine the functional capacity of muscles with the general population (Aufsesser et al., 1996). Although the reliability of hand-held dynamometers (HHDs) has been established with nondisabled individuals, few studies have verified its reliability in people with intellectual disabilities.

Montgomery et al. (1988) measured the muscular strength of adults with moderate intellectual disabilities using handgrip dynamometer. Muscular endurance was evaluated using sit-ups and push-ups, as outlined in the CPAFLA (1997). Montgomery et al. (1988) reported a coefficient test-retest reliability of 0.88 for the handgrip dynamometer (sum of right and left scores) though lower values for sit-ups and push-ups (0.63 and 0.62, respectively). Researchers suggested that the tests were highly influenced by subject motivation. Compared to general population norms in the CPAFLA (1997), subjects in these studies demonstrated inferior strength and endurance. Due to inconsistent performance on push-ups and sit-ups, Pitetti et al. (1993) suggested repeating these test components more than once.

Modified procedures for implementing these tests included testing subjects in their work place with encouragement from peers and nondisabled employees, extensive familiarisation and pretest instruction using teaching cues (verbal and physical prompts) to maximise understanding of task expectations (Montgomery et al., 1988; Reid et al., 1985). Montgomery et al.'s (1988) 6-month exercise regimen produced significantly improved sit-up scores, which may have been encouraged by learning this test component during the exercise programme. Further studies should aim to determine whether people with intellectual disabilities need to be taught maximal exercise tolerance.

Pitetti et al. (1988) used handgrip strength (left and right) to field test people with intellectual disabilities. They also retested subjects in the laboratory using only the dominant hand and found a high reliability ($r = 0.95$). Pitetti et al. recommended using handgrip strength when testing people with intellectual disabilities.

A handgrip dynamometer requires a single, maximal effort that is not highly technical. For instance, the equipment requires less technique than lifting a maximal free weight. The handgrip dynamometer is a reliable measure for people with
intellectual disabilities. The exercise can be repeated in the same test session without excessive fatigue. Achieving maximal force may be challenging for some individuals. When using hand-held dynamometers to test the strength of individuals with cognitive impairments, verbal prompts, such as "push", "squeeze", or "push hard", may ensure valid and reliable scores (Horvat et al., 1995).

Nicholas Manual Muscle Tester. Croce and Horvat (1992) reported a feasible and reliable field device, known as the Nicholas Manual Muscle Tester (NMMT), to measure isometric strength among people with intellectual disabilities. Reliability of composite isometric strength scores was ascertained at 0.82. Strength measurements were recorded for the triceps, biceps, deltoid, and abdominal muscles. Subjects showed improved strength after the training programme, but little information was provided about test administration. Only three adult subjects with moderate intellectual disabilities were tested, and strength relative to the general population was not considered.

Recently, Aufsesser et al. (1996) reported that the NMMT and the Microfet, two commonly used hand-held dynamometers, could be used to obtain objective isometric muscle strength values in a field-based setting with intellectually disabled individuals. Horvat et al. (1995) recommended using verbal prompts to increase motivation, giving adequate rest between test intervals, and including contraction times of 2–5 s. In addition, the researchers recommended using the mean of three trials with subjects with intellectual disabilities, since replicating a maximal score can be difficult.

Isotonic Strength Testing. Rimmer and Kelly (1991) used seven Nautilus and one pull-up machine to evaluate isotonic strength in people with intellectual disabilities before and after a programme involving Nautilus training. The tests (leg extension, leg curl, pull-over, pectoral deck, shoulder abduction, biceps curl, and triceps extension) established the maximum weight an individual could lift (one repetition maximum or 1-RM). To motivate subjects, testers provided verbal reinforcement. On the pull-up machine, the number of maximum repetitions was recorded. Reliability coefficients ranged from 0.95 to 0.99. This type of strength testing provided baseline data and enabled testers to compare strengths before and after training, but little information was provided regarding subjects’ ability to perform the required tests, or the necessary type and amount of pretest instruction.

Isokinetic Strength Testing. Pitetti et al. (1993) described a procedure using a Cybex dynamometer to test isokinetic strength in people with intellectual disabilities. Elbow and knee extension of the dominant leg and arm were tested. A general muscular warm-up using Schwinn ‘Air-Dyne’ ergometry or treadmill walking preceded strength testing. Constant verbal encouragement was provided during testing. Ten practice repetitions of extension and flexion with graded effort preceded the formal test. This comprised two moderate- and two maximal-intensity repetitions. Values ranged from 0.76 to 0.92 for subjects with mild to moderate intellectual disabilities. The researchers suggested that tests should be performed on two separate days, with the best effort recorded. Over 40% of the subjects tested elicited their best effort on the second day. In a study on people with intellectual disabilities (with and without DS), Pitetti et al. (1992) found that both subject groups had less isokinetic strength compared to nondisabled peers. Furthermore, people with DS exhibited lower isokinetic strength compared to people without this condition.
Consequently, several strength measures have proven feasible and reliable when administered to people with intellectual disabilities, though test validity has not been confirmed. The motivation required to elicit maximal force on one repetition or maximal repetitions may be difficult to assess. Offering more than one test opportunity is procedurally sound, either in the same testing session or on different test days, for subjects to demonstrate maximal potential (Horvat et al., 1995; Montgomery et al., 1988; Pitetti et al., 1993). Teaching people with intellectual disabilities to push, pull, force, hold, or squeeze with maximal effort requires imaginative tactics. For example, teaching a subject to apply maximum force may require asking the subject to demonstrate pressure on the tester’s hand or squeeze until effort requires a grimace or yell.

When sit-ups (or preferably, curl-ups) and push-ups are used, two problems are common, aside from motivational factors: some people may not have the strength to complete one repetition, and coordination is often poor. In addition, a fitness appraiser must consider the individual’s technique when scoring these test items. Some people may consistently display poor technique despite repeated corrections and prompts. The Canada Fitness Award Adapted for use with Trainable Mentally Handicapped Youth (1985) created two levels of partial curl-ups and three of push-ups to accommodate these problems. Designing standards and multiple levels for test items may facilitate selecting the most appropriate test for people with intellectual disabilities. McCubbin et al. (1991) and Shephard (1990) agree that this fitness component requires further attention.

**BODY COMPOSITION**

Body composition evaluation has primarily used skinfold measurements, as described in the CPAFLA, but with various regression equations. Following validation against hydrostatic weighing, Rimmer et al. (1987) found two particular formulae to accurately estimate percentage body fat for men and women with intellectual disabilities. Rimmer et al. developed a third equation, subsequently validated when used on men with DS.

Many studies have reported excess body fat or obesity among people with intellectual disabilities (Kelly et al., 1986; Montgomery et al., 1988; Rimmer et al., 1993). Comparing these studies is difficult due to a lack of universal criteria for obesity (e.g., 10–20% over ideal body weight), and different methods for estimating body fat (e.g., height/mass ratios vs. skinfold). Most studies have used regression equations developed for nondisabled persons. Women were consistently more obese than men in these studies. A relationship between intellectual disability level and the prevalence of obesity was also noted. Kelly et al. (1986) found a higher incidence of obesity in people functioning at mild and moderate levels compared to people with severe or profound disabilities. Rimmer et al. (1993) found that obesity was also related to the subjects’ living arrangements, which may reflect the reduced supervision and greater independence of eating habits in less restrictive settings.

*Evaluation by Skinfold Measurements.* Montgomery et al. (1988) and Reid et al. (1985) used the protocol for skinfold measurements outlined in the CPAFLA (1997) to estimate body fat among people with intellectual disabilities. Reid and colleagues (1985) reported a reliability coefficient of 0.95 for the body composition test for adults with moderate intellectual disabilities. Subjects were familiarised with the skinfold callipers and subsequently put at ease. Testers allowed time to
establish a rapport with subjects, and intimidated subjects were allowed to watch a more confident peer being tested. The CPAFLA protocol enabled comparing test subjects with nondisabled Canadians of similar age and gender.

Kelly et al. (1986) also used skinfold and girth measurements to estimate body fat using the Jackson and Pollock (1978) regression equation. Fox and Rotator (1982) used the triceps skinfold and measurements from height/mass tables to evaluate body composition. This method is not recommended in general due to low reliability (McArdle et al., 1991). Researchers have not confirmed the validity of using regression equations and norms for the general population, especially when testing individuals with DS, who are predisposed to obesity.

**Evaluation by Hydrostatic Weighing.** Rimmer et al. (1987) hydrostatically weighed adults with moderate to severe intellectual disabilities, inspiring to total lung capacity. Investigators tested the validity of 12 published regression equations to predict body density and percentage body fat among test subjects. The Jackson and Pollock (1978) equation was determined best for the men, the Jackson et al. (1980) equation best for women. Investigators developed a simple regression equation for estimating percentage body fat in male adults with intellectual disabilities. This equation, which does not require skinfold measurements, may be useful for subjects who react poorly to skinfold callipers or when appropriate measurement sites for obese subjects are hard to measure. Only two circumferences, height and body mass measurements, are necessary. A multiple R value of 0.86 and a cross-validation of 0.81 were obtained for the Rimmer et al. (1987) equation. Investigators concluded that this simple equation was an accurate, reliable, and inexpensive method for estimating percentage body fat for adult males with intellectual disabilities.

Ovalle et al. (1991) used hydrostatic weighing to test the validity of 18 equations on men with DS. The Rimmer et al. (1987) equation rated highest at \( r = 0.89 \) and was thus recommended for this subgroup. The researchers recommended conducting hydrostatic weighing in a comfortable and familiar environment (e.g., a swimming pool) and encouraging participants to visit the site frequently. A familiar residential staff member or caregiver should be present during test sessions. Furthermore, several training sessions should be conducted to familiarise participants with the testing protocol.

**FLEXIBILITY**

Flexibility has received the least amount of attention in fitness studies pertaining to people with intellectual disabilities.

A limited number of studies have used the trunk flexion test described in the CPAFLA manual to assess flexibility. Reid et al. (1985) and Montgomery et al. (1988) assessed the flexibility of adults with intellectual disabilities. Investigators measured trunk flexion using the sit-and-reach test in 184 and 171 subjects, respectively. In both studies, subjects demonstrated lower flexibility levels than norms for nondisabled peers (CPAFLA, 1997). Reid et al. (1985) also found the sit-and-reach test to be highly reliable \( (r = 0.94) \).

Watkinson and Wall (1982) reported that visual feedback was useful in obtaining optimal performance by people with intellectual disabilities. Investigators designed a sit-and-reach apparatus with a built-in feedback mechanism that allowed subjects to assess how far the bar was pushed. In addition, verbal reinforcement
provided extra incentive to push the bar farther on the second trial. Consequently, the sit-and-reach device was motivational for people with intellectual disabilities, although this component was not formally tested in the study.

The AAHPERD Physical Best Test Battery (AAHPERD, 1988) incorporates a sit-and-reach test to evaluate flexibility as a health-related fitness component for people with intellectual disabilities. Flexibility is best assessed with other fitness parameters in studies that focus on cardiovascular fitness or programme effectiveness. Future research should aim to further assess flexibility among individuals with disabilities, since little is known about this area.

**Counselling**

Before designing a physical activity programme, exercise specialists should discuss fitness test results with the participant, ensuring that the individual understands measurement values and test result implications. A method for delivering this information and prescribing programmes for people with intellectual disabilities has not been established. When counselling someone with an intellectual disability, the fitness appraiser must consider several factors specific to each individual:

- Intellectual capabilities
- Motor abilities
- Performance characteristics
- Personal preferences
- Living situation
- Existing and potential support networks
- A medical condition that may require special attention
- Accessible community facilities

Reid et al. (1990) developed a successful model for fitness counselling and programming that combines sound fitness training principles with elements from an objectives-based approach to teaching motor skills to people with intellectual disabilities. Goal sheets, progress charts, intermittent reinforcement, and follow-up are essential elements to successful programming.

In this section, steps four to seven from the Seven Step Model for interpreting fitness scores and counselling (outlined in the CPAFLA manual) will be used as a general guideline.

**INTERPRETING RESULTS**

The level of disability is defined by limited personal capabilities and insufficient adaptive behaviour skills. Subaverage intellectual functioning refers to a standardised IQ score ≤75. People with intellectual disabilities are also limited by abstract thinking, concept formation, generalisation, problem solving, and evaluation (Bouffard, 1990; Sherrill, 1993). These cognitive areas are affected to varying degrees, according to the level of cognitive impairment.

Generally, people with mild intellectual disabilities (see characteristics for mild in Table 1) can better understand explanations of fitness scores, compared to people classified as moderate to severe. However, individuals often want varying
amounts of detail. Some people may be more inquisitive and ask various relevant questions whereas other participants may be unable to understand or attend to lengthy explanations. Suggestions highlighted in the CPAFLA manual (1997) for interpreting results for the general population are applicable to people with mild intellectual disabilities. In particular, vocabulary should be simple, and fitness jargon should be avoided. Idioms (e.g., "it's time to turn over a new leaf") should be avoided altogether, since they may cause confusion (Ezell & Goldstein, 1991). Charts, tables, graphs, or other props are useful visual aids for non-disabled people but may be too complex for people with intellectual disabilities. However, visual aids are also effective teaching and communication tools. Generally, charts and graphs illustrate too much information and need simplification or modifications for interpretation. Concrete analogies may be helpful as well.

Individuals with moderate intellectual disabilities may require additional techniques to understand fitness information. Some clients may have greater receptive and expressive language difficulties along with less developed cognitive skills. Speaking "baby talk" with adults is inappropriate. Rather, speaking clearly, with simple vocabulary and short sentences is developmentally appropriate. At times, alternative communication methods are necessary (e.g., communication picture boards). Assistance and suggestions from support staff and caregivers can help the fitness appraiser in these circumstances.

Some individuals may have difficulty interpreting a numerical score. As with the general population, numerical test results should be translated into accessible meaning. The fitness appraiser should initially determine what the individual finds meaningful. For example, many people are familiar with professional sport role models (e.g., Wayne Gretzky) or television figures (e.g., Arnold Schwarzenegger). Examples and analogies can make reference to these individuals, who place a high priority on health and physical fitness. Note the following hypothetical example.

You did (this many) curl-ups, which means your muscles get tired very quickly. Wayne Gretzky is in shape. He exercises by practising and playing hockey. He would probably do (this many) curl-ups if he were tested the same way, which means his muscles are very strong and don't get tired so easily. Would you like to be strong and in shape, too?

Explanations of fitness test results should be simple, concrete, and adjusted to the level of understanding of the participant. Fitness appraisers must respect an individual's right to access personal testing information and should try to relay all information in the most appropriate manner.

People with severe to profound disabilities rarely seek formal fitness counselling. However, an encouraging caregiver or support worker may bring a client to a fitness centre to use exercise equipment. According to Block (1992) "adults with profound disabilities" refers to people who have very limited cognitive, movement, and communication skills (see Table 1) and are very prone to health disorders and medical complications. However, these individuals can learn and are entitled to fitness programming. Programming for these individuals should be functional, often aim to develop and maintain basic levels of physical fitness skills, and may be based on partial participation. Physical therapists often supervise these programmes, which are implemented by adapted physical educators (Block, 1992).
DISCUSSING ACTIVITY PREFERENCES AND INTERESTS

The recommendations outlined in step five for the general population (CPAFLA, 1997) also apply to people with intellectual disabilities. In particular, fitness programme adherence and success are greatly dependent on whether a programme caters to the individual’s personal preferences. Depending on the person’s physical activity experience, varying degrees of information may come from simple questioning procedures. Completing written questionnaires is generally difficult for individuals with an intellectual disability. Speaking directly to the individual, support personnel, and caregivers elicits the most direct information.

The fitness appraiser should be specific when questioning people with intellectual disabilities. Open-ended questions may be too vague for some individuals (e.g., What kind of activities do you like to do? How often do you do them?). Specifically labelling an activity may elicit more information (e.g., Do you like to walk outside when the weather is nice? How many times a week do you go for a walk?). Using pictures of people exercising, and paying particular attention to facial expressions can be helpful to determine an individual’s preferences, especially for people with expressive communication disorders. Also, short videotapes of people engaged in activity provide a medium to discuss activities and facilitate observing a person’s reaction to what is being viewed. Giving the individual a tour of the fitness facility while various programmes or activities are in progress may also produce more information from a client. Numerous methods may provide a clearer picture of an individual’s activity preferences.

MATCHING PREFERENCES AND APPRAISAL RESULTS

Sherrill (1993) suggested that programming for people with intellectual disabilities should be guided by normalisation and ecological or social validity. That is, people must be afforded living and learning opportunities that are appropriate to chronological age and facilitate social and community acceptance. Meaningfulness and generalisability ensure that activity programmes are carried through and not confined to one context. In addition, Block (1992) described a “functional, life-skills” curricular model, which illustrates generic programming principles for all people with intellectual disabilities. Block suggested that programmes be functional, age-appropriate, community based, and chosen by the participant.

Functional Skills. Block (1994) outlined a functional, or ecological, approach to activity planning, which looks at the skills an individual has and needs to successfully participate in physical activity in natural environments. Functional skills are frequently used by all people in natural, domestic, vocational, community, and sport and recreation environments, and affect survival, physical well-being, and a disabled person’s ability to function independently and productively at home, work, and in the community. To determine whether a skill is functional, consider whether it is used regularly by people with disabilities.

The following examples are all related to some of the adaptive skill areas in the definition of intellectual disabilities. Knowing what kind of clothing to wear when exercising is a functional skill related to self-care, and one that most nondisabled persons take for granted. Knowing which bus to take to a fitness club is a functional skill related to community use. Knowing how to use fitness equipment in an exercise facility involves functional skills related to leisure. Individuals
require different levels of support to achieve these skills, depending on individual strengths and weaknesses in the adapted skill areas.

**Chronological Age–Appropriate Skills.** The prescribed programme should be age appropriate and based on chronological rather than mental age or functional abilities. Although a fitness appraiser should consider an individual’s functional abilities, activities should also be selected according to what the client’s same-age peers would enjoy. Clearly, chronological age–appropriate programming minimises stereotyping people with intellectual disabilities in society and maximises socialisation with nondisabled people and community acceptance. The message is simple: 25-year-old adults should not be playing Duck-Duck-Goose simply because they may function at a lower mental age. Rather, these adults should have opportunities to take an aerobic dance class or perform a routine on a universal gym apparatus. Functional ability should be addressed through difficulty of the routines and level of support provided to the individual rather than through the prescribed activity.

**Community-Based Instruction in Natural Environments.** Community-based instruction in natural environments refers to programming functional, age-appropriate skills in applied environments. Generalisation is often difficult, and teaching a skill in an artificial environment may require reteaching in the community where skills are applied.

Attending a fitness class or joining a fitness club requires functional, age-appropriate physical skills as well as other adaptive behavioural skills, such as providing identification, using a locker and lock, showering, and grooming. Even though an individual may independently use basic daily-living skills at home, reteaching may be necessary in a new environment. These skills are most appropriately taught in the actual environments (i.e., fitness club) where applied.

Designing community-based programmes requires identifying and prioritising functional environments. Thus, the availability of certain facilities in a particular community will determine whether a skill is truly functional (Block, 1992). Choice making further defines the settings.

**Choice Making.** People with intellectual disabilities often receive provisions to such an extent that personal preferences are not considered. In fact, some people with intellectual disabilities do not know how to make choices, having had few opportunities to do so. Choice making need not be limited to selecting activities. Choosing peers or support personnel for accommodation during initial sessions can be validating. Also, choosing the time and duration of rest intervals or the type of equipment can be fulfilling and motivating for an individual.

**DESIGNING A PHYSICAL ACTIVITY PROGRAMME**

Designing a programme should be systematic and provide opportunities to reassess and revise goals. Watkinson and Wall (1982) outlined a teaching model that has been used successfully in adapted physical activity. The model begins with an assessment phase, then establishes realistic medium-range goals. An action plan is then developed (i.e., teaching steps or a fitness progression). Evaluation is the final step. A feedback loop allows continually reassessing programme goals and priorities.

Reid et al. (1990) developed a fitness programme for adults with intellectual disabilities employed in sheltered workshops in Montreal, Quebec. The programme combined scientific principles of athletic training and Watkinson and Wall’s (1982)
model. The Stepping Out for Fitness (Reid et al., 1990) programme is now cited as a curriculum model by Sherrill (1993) and includes five components: assessment, objectives, task analysis, implementation, and postevaluation. The assessment used the CPAFLA (1997). Each of the 48 lessons included a warm-up, conditioning segment, and cool-down, with specific activities for flexibility, cardiovascular conditioning, and muscular endurance. Prompts were provided for each exercise. Lessons were built around a variety of themes (e.g., aerobics, circuit training, and a running club). Exercises were functional and age appropriate. However, the programme was conducted in a segregated environment. The basic programme format can be easily adapted and other activities interchanged, depending on personal preferences and community facilities available.

Goal sheets similar to the Action Plan Worksheet in the CPAFLA (1997) are useful for people with intellectual disabilities. However, a simplified version of this worksheet may be necessary. For instance, a separate goal sheet for each timeframe may be easier to interpret and provide a sense of accomplishment as an individual moves through each timeframe. While less structure may work for some people, a more structured approach is probably better for most individuals with intellectual disabilities.

The Stepping Out for Fitness (Reid et al., 1990) programme used certificates of achievement to mark the accomplishment of successive programme sections. External reinforcement (both verbal and tangible) may be a beneficial addition to programme format. Frequent check-ups are important: they give participants an opportunity to demonstrate progress and provide opportunities to make programme adjustments, offer counselling to the participant, and supply intermittent reinforcement.

In short, the fitness programme should be straightforward, incorporate as many elements of personal interest as possible, be simple to implement, use facilities that are easily accessible, include frequent check-ups or follow-up sessions, and be flexible, allowing for revisions.

Specific Recommendations for the Fitness Assessment of Persons With Intellectual Disabilities

TEST PROTOCOL

Aerobic Fitness (Field Test). Modifying the CHFT/CAFT should proceed as described by Montgomery et al. (1988; 1992), who implemented the following test modifications:

- Extensive familiarisation of subjects
- An appropriate prompting system (with appropriate details specified in the final manual)
- Number of step ascents (to be used in the prediction equation)
- A heart rate monitor to count heart beats in the last 10 s of exercise
- A modified CAFT step test can provide a reliable and valid estimate of aerobic fitness.

Muscular Strength and Endurance. Recommended field test modifications (Montgomery et al., 1992) include the following:
1. Handgrip force:
   • Extensive familiarisation
   • Detailed pretest instruction and practice
   • Maximal encouragement and prompting
   • A minimum of two definitive trials with scores agreeing within 5%

A handgrip strength test with appropriate modification can be used to measure the strength of persons with intellectual disabilities.

2. Sit-ups/push-ups:
   • Adequate pretest instruction
   • An appropriate prompting system that emphasises maintaining quality of movement as the test continues
   • Qualitative and quantitative evaluation (e.g., levels of difficulty)

Sit-up and push-up tests are often difficult to perform when evaluating the muscular strength and endurance of persons with intellectual disabilities. Measurement criteria may require qualitative and quantitative scoring.

**Body Composition.** Recommended modifications to field measures of skinfold and girth include the following:

   • Carefully developing a rapport with the subject
   • Detailed familiarisation of the client with the test
   • A video of testing or watching measurements taken on a peer
   • Appropriate regression equations

The formula currently used in the CPAFLA may merit reexamination, given the current popularity of the Jackson formula. In addition, girths may need to substitute for skinfolds in some individuals, but careful administration usually allows estimating body fat from skinfold determinations. Rimmer et al. (1987) have provided circumference-based equations appropriate for able-bodied individuals and men with DS.

**Flexibility.** Sit-and-reach test recommendations include the following:

   • A prompting system limited to visual feedback to avoid prejudicing scoring
   • A minimum of two trials

Flexibility can be measured for individuals with intellectual disabilities, using a modified test of trunk flexion.

**Recommendations for Counselling Persons With Intellectual Disabilities**

Exercise training programmes for persons with intellectual disabilities should include the following characteristics:

1. Emphasise simplicity and straight-forward procedures.
2. Include activities that are functional, age-appropriate, community based, and incorporate choice making by the individuals.
3. Follow the same training principles that apply to the general population (where possible).
4. Incorporate worksheets and charts that are simple and easy to understand.
5. Use adapted motivational tactics, such as rewards, certificates, shopping trips, and opportunities for desired activities with personally significant support personnel.
6. Incorporate more frequent follow-up than required by the general population, allowing for modification of programmes and counselling as determined by programme response.
7. Incorporate assistance from support personnel where necessary (e.g., free admission for an assistant).
8. Modify test procedures and pedagogy for people with intellectual disabilities.
9. Include test standardisation that is sensitive to subjects’ understanding of required procedures.

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