PHYSICAL FITNESS OF ADULTS WITH AN INTELLECTUAL DISABILITY: A 13 YEAR FOLLOW-UP STUDY

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ABSTRACT

The purpose of this study was to describe the physical fitness of middle-aged adults with an intellectual disability and how their state of fitness has changed over time. Thirty-two adults with an intellectual disability served as participants: 14 were female and 18 were male. Participants had an age range from 34 to 57 years. All worked at a readaptation center in Montreal and were participants in a study of physical fitness in 1983. Using the "Canadian Standardized Test of Fitness", the participants were evaluated on tests of Cardiovascular Endurance, Muscular Strength, Muscular Endurance, Flexibility, and Body Composition. All participants were deemed physically capable of performing all the tests after a screening procedure was used. A home visit, previous to the testing session, familiarized the participants with the procedures for each test. The battery of tests took one hour per participant. Three levels of analysis were used to describe the change in physical fitness with age: First, the conversion of raw scores into percentiles highlighted individual differences within the group. Second, to assess the change in fitness over time, a 2x2 (group x time) repeated measures design was used. Third, effect sizes were calculated to measure the magnitude of change in fitness over the 13 year period as compared to the general population. Results indicate that, when compared to the general population, the participants had lower levels of fitness and that their fitness had changed significantly over time. Most interesting were results showing that the participants had a significantly greater magnitude of change in VO2max and percent body fat than what is expected in the general population. The findings of this study raise concerns regarding the potential health risks associated with aging and poor fitness for adults with an intellectual disability.

RESUME

Le but de cette etude etait de decrire la condition physique d'adulte d'âge moyen ayant une déficience intellectuelle, et aussi comment l'etat de leur condition a changé au cours du temps. Trente-deux adultes comportant une déficience intellectuelle ont servi en tant que participants: 14 femmes et 18 hommes. Leur âge respectif variait de 34 à 57 ans. Tous travaillaient dans un centre de réadaptation à Montreal et participant à une etude sur la condition physique en 1983. A l'aide du "Canadian Standardized Test of Fitness", les participants ont été evalué sur leur endurance cardiovasculaire, leur force musculaire, leur endurance musculaire, leur flexibilité, et leur composition corporelle. Tous les participants étaient jugés capable d'accomplir tous les tests après qu'une procédure de depistage soit utiliseé. Des visites a la maison, effectueés avant la session d'évaluation, ont familiarisé les participants aux differents procédures de chaque tests. La batterie de test a pris une heure par participant. Trois niveaux d'analyse ont été utilisé pour décrire le changement de la condition physique avec l'âge. Premierèment, la conversion des resultats bruts en pourcentages a mis en valeur les différences individuelles au sien du groupe. Deuxièmement, afin d'estimer le changement de condition physique au fil du temps, un concept de mesures repetées (2x2, group x temps) a été utilise. Troisiemement, les effects-granduer ont été calculés pour mesurer la magnitude de changement de la condition physique pendant la periode de 13 ans telle que comparée à la population en generale. Les résultats indiquent que, comparés à la population en gènéral, les participants avaient un niveau de condition physique moins èléve et que celle-ci avait changé de facon signifiante au fil du temps. Un fait intéressant fût celui des résultats dèmontrant que les participants avaient une magnitude de changement en VO2max et du pourcentage de tissus adipeux corporel beaucoup plus élevé que ce qui est prevu dans la population en gènèral. Les constatations de cette étude soulèvent quelques inquiétudes au sujet de risques potentiels à la santé associés au vieillissement et a une pauvre forme physique d'adultes ayant une dèficience intellectuelle.

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Chapter 1

Introduction

There is growing recognition among health professionals that lifestyle choices contribute a great deal to the quality of one's life (McAuley & Rudolph, 1995; Paffenbarger, 1990). Lifestyle choices such as participation in physical activity, eating habits (Wood, 1993), and smoking have been linked to mortality (Seccareccia & Menotti, 1992), the prevention of disease (Jette, Sidney, Quenneville, & Landry, 1992), psychological well-being (McAuley & Rudolph, 1995), and the state of personal physical fitness (Blair, 1995). Making positive lifestyle choices appears to contribute to overall health in a beneficial manner.

Lately, health-related physical fitness, in the middle age of one's life, has become a major concern. Several studies have demonstrated that a significant decline in fitness occurs throughout middle age (Going, Williams, Lohman, & Hewitt, 1994; Lee, Paffenbarger, & Hsieh, 1992; Paffenbarger, Kampert, Lee, Hyde, Leung, & Wing, 1994). The decline in fitness during the middle age years has been positively correlated with a decrease in the amount of physical activity one engages in during this same period. In fact, some reports show an inverse relationship between the amount of physical activity and the incidence of common chronic diseases such as some forms of cancer and diabetes mellitus (Rauramma, Tuomainen, Vaisanen, & Rankinen, 1995). Estimations suggest that if half the population of sedentary individuals in the United States would become even moderately active, the number of deaths occurring from coronary heart disease, colon cancer, and diabetes would fall by 22,000 per year (Blair, 1995). More dramatic estimates would be expected if more individuals would become moderately to highly active. Empirically-based research has yet to determine how the interaction of each variable mentioned above contributes to the decline of fitness throughout one's life. Regardless, evidence exists that the adoption of an active lifestyle can increase one's level of physical fitness and may have a positive influence on one's health. As a result, lifestyle choices associated with physical activity have become an important and meaningful area of inquiry.

In 1981, the most extensive and comprehensive study of fitness and physical activity patterns was undertaken in Canada (Government of Canada, 1982). The survey tested approximately 16,000 Canadians ranging in age from 7 to 69 years. More specifically, the survey evaluated the physical fitness components of body composition, cardiovascular endurance, muscular strength, muscular endurance, and flexibility. From the age of 20 onwards, a clear decline in performance was observed in all five components as age increased. With the exception of muscular strength, this decline appeared to accelerate notably in the early middle age years (age 35).

Cardiovascular endurance is considered to be the most prominent component of fitness as "it reflects the efficiency of the heart and lungs in moving energy-laden oxygen from the air to the muscles that need it" (Government of Canada, 1982, p.10). Cardiovascular efficiency is fundamental in allowing individuals to sustain any activity during work or play. As well, authors recognize that cardiovascular health risks associated with inactivity and poor fitness may have a role to play in the acquisition of coronary heart disease, elevated cholesterol, stroke, and hypertension (Bokovoy & Blair, 1994; Powell & Blair, 1994). The "Canada Fitness Survey" showed that cardiovascular fitness continued to fall steadily throughout the age span. On the "Canada Home Fitness Test" (CHFT) (Government of Canada, 1981), a majority of the population reached a recommended level of cardiovascular fitness or 85% of their maximum workload. One-third reached a minimal level or 70% of their maximum workload, and about 5% of those tested performed at an unacceptable level or a workload at 70% of maximum for someone 10 years older. Interestingly, the proportion of individuals screened out of the testing, due to exercise related health risks, remained very consistent and did not substantially increase until the age group of 45 to 64. Despite the fact that the majority of subjects reacher 85% of their maximum workload, the older subjects did not fare as well. Only 7% of the 65 to 69 year old participants reached 85% of their predicted maximum workload. Those screened out of the testing were broadly considered unfit. As with cardiovascular fitness, the flexibility of participants began declining in the earliest years continuing throughout the age span with a marked decline after the age of 24. The component of muscular endurance was also undoubtedly related to age with peak performances observed around 14 to 15 years of age with a steady decline afterwards. In comparison, the muscular strength of participants peaked between 20-39 years of age and declined slightly throughout the years. Participants in the survey showed a gradual accumulation of body fat until the age of 50-59.

It is evident from the results of The Canada Fitness Survey that a decline of fitness occurs throughout one's lifetime and is pronounced during the middle age years especially for the component of cardiovascular fitness. Yet, the decline in fitness is likely related to decreased participation in physical activity.

The relationship between physical fitness and physical activity throughout the middle age years has been studied by Seccareccia and Menotti (1992) and Sandvik, Erikssen, Mundal, and Rodhal (1993). In a 25-year follow-up study of 1720 middle-aged Italian men, Seccareccia and Menotti (1992) showed that those who remained active throughout the 25 years were less likely to die of coronary heart disease. In their 16-year follow-up study of 1960 apparently healthy men, Sandvik et al. (1993) determined that the difference between resting heart rate and exercise induced heart rate was a consistent predictor of cardiovascular mortality. Those with low resting heart rates had a decreased risk of dying prematurely from cardiovascular heart disease and interestingly, tended to participate in more physically demanding work activities. The results from these studies imply positive benefits from increased participation in physical activities.

Most of the population have the ability and the opportunity to attend to their own health. As a result, most public and private campaigns (i.e., YMCA, Participaction) designed to educate and encourage society towards leading a healthy and active lifestyle, are geared to those who have the competence to be able to use and benefit from these campaigns. The question of freedom of choice and preference are some major factors which challenge able-bodied citizens to pursue an active lifestyle. However, there are groups of people who require assistance in seizing opportunities to live a healthy and active lifestyle. One such group, representing roughly between 1% (American Psychological Association, 1992) and 3% (Sherrill, 1994) of the population, is persons with an intellectual disability. It is questionable whether persons with an intellectual disability are aware of the debilitating consequences of a sedentary lifestyle. Even if they were made aware through education, it is debatable whether they would have enough self-direction to modify their lifestyle (Pitetti, Rimmer, & Fernhall, 1993).

It is well founded that persons with an intellectual disability exhibit poor fitness performance on standard fitness tests (Beasley, 1982; Coleman, Ayoub, Friedrich, 1976; Fernhall, 1993; Pitetti, Jackson, Stubbs, Campbell, & Battar, 1989; Reid, Montgomery, & Seidl, 1985). In fact, some studies report that persons with an intellectual disability involved with physical activity, may perform poorly on fitness tests in comparison to sedentary non-disabled persons (Pitetti et al., 1989; Reid et al., 1985). These poor levels of physical fitness have been attributed to variables such as poor motor control (Moon & Rezaglia, 1982), a sedentary lifestyle (Burkart, Fox, & Rotatori, 1985), institutionalized living (Pitetti et al, 1993), and genetic factors as with some persons with Down's syndrome (Block, 1991). There is speculation that the rate of decline in physical capabilities of persons with an intellectual disability is faster than that of the general population (Pitetti & Campbell, 1991). In fact, persons with an intellectual disability have an established lower limit for the onset of old age as well as a higher mortality rate (Pitetti & Campbell, 1991).

Maintaining an adequate amount of physical fitness is especially crucial throughout one's lifetime and especially throughout ones adulthood. With the thrust towards de-institutionalization, persons with intellectual disabilities face challenges in all aspects of community life (Pedlar, 1990). Many facets of community life, such as work, maintaining a household, cooking, self care, and recreation require the individual to possess a certain amount of physical stamina. Persons with an intellectual disability will require an adequate amount of fitness to contribute in a society that values excellence, not only to complete work tasks, but also to enjoy and benefit from participation in recreational activities (Fernhall, Tymeson, & Webster, 1983).

The decline of fitness during middle age, although well established for the non-handicapped population, has not been given much attention for persons with an intellectual disability. Of course, participation in physical activity leading to improvements in general health would be a viable goal for persons with an intellectual disability, however, the research in this area is "scattered, incomplete and hampered with poor research designs" (Fernhall et al., 1983, p.24). Studies concerning the physical fitness of persons with an intellectual disability (Pitetti et al., 1993) have examined physical fitness performance, validation of fitness testing procedures, training, exercise programming, and body composition. Although these studies provide invaluable information about the fitness of persons with an intellectual disability, an insufficient amount of data-based research exists isolating the variable of aging and its role on the physical health of this population. Conclusions have been made citing a number of potential factors explaining the low fitness levels of persons with an intellectual disability, including sedentary living, environmental and genetic influences, that they are subject to a higher mortality rate and early onset of cardiovascular disease. Research on the interaction of these factors has been based on evidence that is both inconclusive and obscure. Hence, the need to expand the database in the area of aging and fitness for persons with an intellectual disability is long overdue.

1.1 Significance of the Study

Large epidemiological studies have shown that persons need an adequate level of fitness to live healthy, disease free lives (Blair, Kohl, Barlow, Paffenbarger, Gibbons, & Macera, 1995; Lee, Hsieh, & Paffenbarger, 1995; Paffenbarger, et al., 1994). The benefits to be gained from an active lifestyle are numerous and may result in a reduction of the following health risks: coronary heart disease, osteoporosis, depression, hypertension, renal disease, type II diabetes, some forms of cancer, depression, anxiety, etc. (Shephard, 1995). As previously mentioned, it is well documented that persons with an intellectual disability exhibit substandard physical fitness when compared with the non-handicapped population. Considering the added effects of obesity (Fox & Rotatori, 1982), it is likely that certain health risks associated with a substandard level of fitness would become an even greater issue for these people. It would therefore, be appropriate to provide opportunities for persons with an intellectual disability to become involved in physical activities, while concurrently working toward having them assume responsibility for their own health. Foresight and planning are skills that the health professional must possess in order to efficiently and intelligently plan for physical activity and fitness programming. With the few existing exercise training programs designed for the specific needs of persons with an intellectual disability, health professionals are left with little to work with. Once information describing the physical fitness characteristics of persons with an intellectual disability is obtained effective physical fitness programming can be administered (Shephard, 1991).

Even though the research community has established a lower level of fitness characterized by persons with an intellectual disability, no data appears exists revealing how their fitness has changed over time. In the Harvard Alumni Health studies, Paffenbarger, Hyde, Wing, Lee, Jung, and Kampert (1993) have done extensive longitudinal work recording the physical activity patterns of thousands of individuals. They have established a link between participation in physical activity and all-cause mortality. The middle age has also been shown to be the period in one's life when some components of fitness begin to steadily decline (Government of Canada, 1981). Assuming that the decline in fitness among persons with an intellectual disability follows the same pattern as those persons without disabilities compounded with an already well documented lower level of physical fitness, this population would be expected to experience difficulty in sustaining the energy needed to perform even the simplest of daily activities. The implications for personal health would also have to be given consideration. Research on aging and fitness may also verify some of the data which describes the higher rate of mortality and early onset of old age in persons with an intellectual disability. It is yet to be determined what magnitude of difference exists between the decline in fitness for non-handicapped persons and the decline of fitness for persons with an intellectual disability.

Accordingly, the significance of an investigation of the physical fitness characteristics of persons with an intellectual disability as they age, is to expand a knowledge base that contains little information regarding the role of aging, physical activity, fitness, and health of persons with an intellectual disability.

1.2 Statement of the Problem

The purpose of this study is to describe the physical fitness of middle-aged adults with an intellectual disability and how their state of fitness has changed over time.

1.3 Hypotheses

1.3.1 As a group, the present fitness of persons with an intellectual disability will be significantly lower than their state of fitness recorded in 1983.

1.3.2 The magnitude of difference in fitness for the group of adults with an intellectual disability between the present study and the 1983 study will be significantly greater than the magnitude of difference in the norms established for the non-handicapped population.

1.4 Delimitations

The following delimitations will be considered in this study:

1.4.1 All participants had participated in a study in 1983.

1.4.2 All participants are middle-aged adults with an intellectual disability between 34 and 57 years of age.

1.4.3 All protocols for testing in this study were replicated from the study in 1983.

1.5 Limitations

The following limitations will be considered in this study:

1.5.1 Factors potentially influencing the physical fitness of adults (i.e., fatigue, anxiety, motivation, etc.) were not measured. Effort was made before and during the testing to reduce the influence of any potential negative factors that could have confounded the results. Participants have known the testers for at least four years. In addition, testing equipment and procedures were fully described to each participant. During testing, verbal encouragement and reassurance was given to help the participant feel at ease.

1.5.2 Measurement of physical fitness did not take into consideration the causes of declining physical fitness. The question posed in this study is to describe the changes in physical fitness of adults with an intellectual disability. Identifying causes for declining physical fitness may make valuable material for further investigation.

1.6 Definitions

Persons with an Intellectual disability: Refers to a significantly subaverage general intellectual functioning (an IQ of approximately 70 or below) with onset before the age 18 years and concurrent deficits or impairments in adaptive functioning (American Psychological Association, 1994).

Physical Fitness: Health related physical fitness is the term most widely accepted (Eichstaedt & Lavay, 1992) and will be defined by the following components to be measured in this study: cardiovascular endurance, muscular endurance, muscular strength, flexibility, and percent body fat.

Cardiovascular endurance: Degree to which one can perform repetitions of stress requiring the use of the circulatory and respiratory system. This will assessed using a modified stepping test.

Muscular strength: Degree to which the muscular system can exert force. This will be assessed using a hand grip dynamometer.

Muscular endurance: Degree to which one is able to perform work repeatedly against a moderate resistance. This will be assessed by the administration of a sit-up test and push up test.

Flexibility: Degree to which one's joints are able to move through the full range of motion. This will be assessed by administering a sit and reach test.

Percent body fat: An individual's degree of body fat is estimated by the summation of skinfolds thickness taken at four body sites.

Blood pressure: A measurement of one's systolic and diastolic blood pressure using a sphygmonamometer and represented in millimetres of mercury (mmhg).

Resting Heart rate: The heart rate taken after the participant has remained quietly seated for a period of five minutes.

Middle Aged: For the purposes of this study middle age will refer to those individuals between 34 and 57 years of age.

Chapter 2

Review of the Literature

The purpose of this study was to describe the physical fitness of middle-aged adults with an intellectual disability and how it has changed over time. The review of literature will be organized in the following manner: (2.1) Contemporary Issues in Fitness and Active Living; (2.2) Age Related Changes in Physical Fitness; (2.3) The Physical Fitness of Persons with an Intellectual Disability.

More specifically, section 2.1 will explore societal changes in the relationship between physical activity, fitness, and health. The inclusion of this section is justified by the fact that not only are perceptions about physical activity changing, but concurrently so are the perceptions about the capabilities of persons with disabilities. Further, more opportunities to participate in physical activity appear to be available for persons with a disability which may have direct or indirect influences on health. Section 2.2 will examine the literature as it pertains to the typical effects of aging on the physical fitness of persons without a disability. This section will focus on changes of specific physical fitness components. Section 2.3 will critically examine information on the unique physical fitness characteristics of persons with an intellectual disability. This section will also critically examine the methods used and the problems encountered when testing these individuals.

2.1 Contemporary Notions of Physical Activity, Fitness, And Health

The relationship between physical activity, fitness, and health has, in recent times, become a topic of much interest for those involved with the health and welfare of others (Quinney, Gauvin, & Wall, 1994). The goal for all people in society, including those with disabilities, is to live productive, healthy, and disease free lives. Interest and discussion of this issue is very timely as there is a concern for escalating health care costs due to an ever increasing proportion of middle aged and elderly people in society. As Shephard (1995) points out, questions about the benefits of an active lifestyle are more than purely academic, but also issues of governmental health policy, due to soaring health and chronic care costs.

The debate over exercise for health versus exercise for fitness has come to the forefront in evolving perceptions about lifestyle choices. The debate is further complicated by additional issues such as; how much activity is suitable to reap health benefits, do lower levels of physical activity have similar effects than higher intensity activities on physical fitness, and how do health agencies and governments intelligently promote active lifestyles?

The interdependent relationship between physical activity, fitness, and health merits some discussion. An understanding of the relationship among the three issues may be facilitated by some definition and discussion of each concept. Physical Activity is "any body of movement produced by the skeletal muscles that results in a substantial increase over the resting energy expenditure" (Bouchard, Shephard, & Stephens, 1993, p. 11). This definition includes not only activities undertaken for the intentional purpose of improving health and performance, but daily living activities where energy expenditure is equivalent to that of fitness. This definition includes activities in leisure pursuits, sport, work, and activities of daily living such as household chores.

Fitness can be defined as the undertaking of moderate to high intensity activity for the sole purpose in improving abilities in cardiovascular endurance, muscular strength and endurance, flexibility, morphology, motor ability, and metabolic function (Shephard, 1995).

Health can be defined as follows:

> "A human condition with physical, social, and psychological...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 morbidity. (Bouchard, Shephard, Stephens, Sutton, & McPherson, 1990, p.11).

The definitions used for this review of literature have been developed from a consensus committee of professionals. They responded to a need for a common understanding of the terms and thus provide a foundation for further discussion of the pertinent issues related to the benefits of a healthy and active lifestyle (Bouchard et al., 1993).

Beginning in the 1920's, the medical community was very sceptical of persons beyond school age participating in vigorous exercise (Holloszy, 1983). There existed a negative attitude toward exercise upheld by previous misconceptions about the effect of vigorous exercise on individuals. It was believed that the greater the energy expenditure and oxygen consumption the shorter the life-span (Holloszy, 1983). This was termed the rate of living theory. This theory, developed by Pearl (1928), was coupled with beliefs that repeated participation in vigorous exercise would contribute to long-term harmful physical effects similar to infections and trauma. No evidence has ever supported the notion that increasing energy expenditure has a negative effect on health, and, as a result, the rate a living theory is not relevant to today's thinking. In fact, increases in energy expenditure have been scientifically proven to cause tissues and organs to develop an adaptive increase in areas of strength and endurance which counters the degenerative changes that occur with age (Shephard, 1987a). It is worth mentioning that the rate of living theory has never been disproved and, as a result, investigation into the negative effects of strenuous exercise on health may have some validity (Holloszy, 1983).

Although the scientific community has not found a way to reduce the aging process, evidence does exist that exercise may produce effects that can slow the deterioration of the cardiovascular, skeletal, and muscular systems (Paffenbarger et al., 1995). It has also been suggested that exercise training may provide protection against cardiovascular disease, insulin dependent diabetes, and high blood pressure (Blair, 1995). This preliminary information about the potential benefits of exercise, which was developed around the mid 1960's resulted in a thrust towards government and community agencies promoting participation in vigorous exercise (Holloszy, 1983).

The fitness movement in the early 1980's highlighted an increased awareness of the benefits of regular participation in exercise and was promoted to be beneficial when performed at a high intensity, duration, and frequency. Although this was a physiologically sound concept, adherence to this type of exercise program was very intimidating for those who were not motivated by the regimen and who could not find the time and energy for such a prescription (Swedburg & Iszo, 1994). The fitness industry's main objective was to get people fit by prescribing an exercise regimen that was goal oriented in nature. However, the fitness industry did not necessarily encompass the idea of living a healthy and active life (Swedburg & Iszo, 1994). The approach during the fitness boom was to test physical fitness and secondly, to offer activity programs through which participants would improve their physical fitness. When the goal of physical fitness was attained, adherence to the program was needed. However, the prospect of performing high intensity activities in sterile conditions was very intimidating for most people and it was also demanding on one's time and money.

In order to promote an integrated view of physical activity, fitness, and health, the Active Living movement was conceived. It was born out of the 1986 Summit on Fitness (Government of Canada, 1986) where leaders from the public and private sector met to discuss the future of fitness and physical activity. An approach was created which would be accessible to all, including persons with disabilities. It minimized the elitism of the fitness movement and focused on a view that physical activity and health could be integrated into all aspects of life. Activity would be fun and range in intensity depending on individual preference. Thus, Active Living was defined as "a way of life in which physical activity is valued and integrated into daily life" (Government of Canada, 1992, p.8). The concept of Active Living was intended to provide a framework from which schools, governments, and communities can encompass physical fitness, activity, and health as an intrinsic value within each of its members. One major selling point of the Active Living campaign is that moderate activity is easier for sedentary individuals to begin when starting from little or no activity.

It has been suggested that moderate activity is easier for individuals to adapt into their lifestyles; easier to change if they are inactive; and a more plausible solution than the intimidating view of high intensity exercise (Casey, 1992). In addition, the moderate approach is far easier to market to most of the population. It affirms the decision that every individual is making to become physically active is valid (Swedburg & Izso, 1994).

However appealing, the idea of Active Living has been questioned with regard to the following: 1) the interpretation of the definition; 2) measurability; 3) which activities included in the broad interpretation of active living actually effect a healthy lifestyle; 4) to what degree is the concept of active living related to more established notions of health, physical activity and fitness; 5) and what is an acceptable level of frequency, intensity, and duration to produce significant health benefits. As a result, agencies are challenged to re-define the strategy they use to promote the concept.

Some authors suggest that the physical activity for fitness orientation towards Active Living is limiting because it implicitly denies the psychological, social, and spiritual benefits to be gained from participation in physical activity (Makosky, 1992). However, Bouchard (1994b) views the Active Living movement with scepticism. He believes that the concept of Active Living is too all-encompassing for those who make claims that any form of activity, whatever the intensity, will produce health benefits; both psychosocial and physical. It is possible that psychosocial benefits may be gained from participating more frequently in leisure time pursuits (McAuley & Rudolph, 1995) however, the implied benefits of some physical activities are subject to protest from professionals involved in physiological sciences. Bouchard (1994b) argues that overall health benefits are best derived from participation in regular physical activity (four days per week) of moderate intensity (40-60 % of maximum) for a duration of 30-60 minutes. He suggests that, until empirical research proves otherwise, health professionals must exercise caution when advocating perceived benefits of participation in light intensity activity.

As one can well imagine, the Active Living concept did not rise solely out of a desperation for agencies to get more people active, but rather, responded to new information on benefits to be derived from moderate exercise (Blair & Powell, 1994; Paffenbarger et al., 1994). Societal changes that were taking place with respect to attitudes towards health and fitness created a need for agencies to react to the anticipation of the mounting health care costs of an aging society. Apparently, the interpretation of the Active Living concept and its claims of improving health are subject to the discretion those involved in promoting this strategy. Research is needed to substantiate or refute the perceived benefits of Active Living. Additionally, an investigation into the availability and accessibility of programs which support the Active Living concept, especially for persons with disabilities, is greatly needed.

Whether it is fitness programs or personal recreational pursuits, documentation shows that benefits can be derived from increased participation in physical activity (Blair, Brill &, Barlow 1992; Bouchard, 1994; Paffenbarger et al., 1992). Contemporary notions of physical activity feature a departure from the physical fitness model of activity towards a more leisure-recreational orientation. Encouraged by the meaningful research which has shown that general health improvements can be derived from moderate levels of physical activity (Blair, 1995; Bokovoy & Blair, 1994; Jette, Sidney, Quenneville, & Landry, 1992; Wood. 1994), more people are being encouraged to participate in leisure and recreational pursuits (Stewart, 1995). The seemingly unattainable goals of the fitness boom have given way to a more holistic view of activity for all people. This idea has potential for opening doors to a multitude of people who otherwise would become discouraged by the unattainable standards set by societies' view of the perfect physically fit person.

Of the multitude of factors which may have beneficial influences on one's quality of life (ie. diet, psychological state, etc.) participation in physical activity is seen as one major factor contributing to well being (Paffenbarger et al., 1994). Although this research is encouraging, not all the information is accurate or conclusive. In response to this concern Shephard (1995) has outlined the research evidence from the consensus conference on physical activity, fitness, and health (Bouchard et al., 1994) identifying the benefits of participation in regular physical activity. Research findings were considered strong, suggestive, or inconclusive (see Table 1).

Table 1 Evidence of the Benefits of Physical Activity on Health

STRONG	SUGGESTIVE	INCONCLUSIVE
-Coronary heart disease	-Vascular disease	-Cerebrovascular accidents
-Hypertension	-Obesity	-Type I diabetes
-End-stage renal disease	-Osteoarthritis	-Back Problems
-Type II diabetes	-Rheumatoid	-Bladder problems
-Osteoporosis	-Chronic lung infection	-Immune function
-Cancer (colon, breast)		-Neuromuscular disorders
-Surgical Trauma		-Pregnancy
-Depression		
-Anxiety		

*** Adapted from Shephard, 1995.**

Physical activity has been coined by some as the miracle medicine for a long and healthy life (Stewart, 1995). If society's function is to provide adequate and cost efficient health care to its members, then the promotion of healthy and active lifestyles must be part of its campaign.

The above information has numerous implications for persons with an intellectual disability. As a traditionally sedentary population (Burkett, Fox, and Rotatori, 1985; Pitetti & Campbell, 1991), they now have access to a concept of physical activity which is more attainable and requires less maximal effort. Makosky (1992) calls for an elimination of the restrictive social attitudes towards specific populations. These attitudes inhibit their opportunity to participate in regular physical activity. Perhaps the concept of Active Living, which justifies the value of moderate to minimal intensity activity, will open a door of opportunity to persons with intellectual disabilities to upgrade a level of physical activity which has virtually remained dormant and sedentary.

For the purposes of this study, the concept of Active Living, will be limited to the information which supports the notion that moderate levels of physical activity of adequate frequency and duration will improve fitness and consequently improve health, reducing the risk of disabling conditions as a result of aging.

2.2 Age-Related Changes in Physical Fitness

Information presented in the previous section of this review suggest that participation in physical activity may have a positive effect on fitness and health, however, important issues need to be resolved. Dose-response (ie. the amount of physical activity needed to reap benefits) appears to be a major area of contention among health professionals (Blair, 1995). Further, while some studies have shown that moderate levels of activity can have an effect on reducing the risk of coronary heart disease, hypertension, stroke, and cancer (Bokovoy & Blair, 1994), controversy still surrounds the appropriate frequency, duration and intensity of activity of exercise.

Information about physical activity and exercise and its effect on health is directly related to a need for researchers to understand the biological effects of aging. Research on aging has been increasing along with a recognition that by the early twenty-first century, there will be a large proportion of baby boomers reaching retirement age (Going et al.,1994). These numbers will have large ramifications on health care costs. Thus, research is attempting to determine what factors contribute to the healthy aging of middle-aged persons. Consequently, the terminal objective of research in aging is to reduce the prevalence of age associated diseases and enhance quality of life (Baker & Martin, 1994).

Aging has inherent effects on physical fitness. It has been reported that regardless of the lifestyle, physical fitness capacity will decrease with age (Government of Canada, 1982; Spirduso, 1995). Despite this fact, gains in physical fitness can be obtained through diligent and regular participation in physical activity. An examination of the fundamental effects of aging on physical fitness capacity and physical activity patterns would perhaps lead to a better understanding of the relationship between physical activity, fitness, health and how, through an increase in personal fitness, we can improve our adaptation to the process of aging (Shephard, 1987a).

Large cross-sectional and longitudinal studies have determined that there is an association between aging and a decline in certain components of physical fitness (Blair et al, 1995; Seccareccia & Menotti, 1992). Interestingly this decline can be further exacerbated by sedentary living (Powell & Blair, 1992). There exists a typical decline in most components of physical fitness components until about the end of middle age (Shephard, 1986). In older age populations the decline in physical fitness capabilities becomes less typical because previous lifestyle choices appear to have an effect on the health of each individual. This review will focus on typical physiological changes during the middle-aged years in physical fitness.

Measurements of height, weight, and skinfold thickness are often used to estimate the body composition. An exhaustive review on the effects of aging and body composition was performed by Going et al. (1994). Changes in body composition are of particular concern and have been shown to correlate with deterioration in functional capacity and risk of some chronic diseases.

Height increases slowly until about 25 years of age and then slowly decreases thereafter (Government of Canada, 1981). More rapid decreases are seen in persons after age fifty (Spirduso, 1995). Females tend to lose height faster than males due to the higher incidence of osteoporosis, especially in the few years before and after menopause. Some authors suggest that effect of bone loss in women occurs before menopause but is exacerbated by menopause (Going et al., 1994; Shephard, 1987b). Other factors which influence a decline in height are diet, heredity, weight, and physical activity patterns (Spirduso, 1995).

Few longitudinal studies exist to track the change in body weight as aging occurs. Most are cross-sectional (ie. Canada Fitness Survey). By comparing different age groups with each other, cross-sectional studies have been criticized for creating false impressions about the true effect of aging that one would expect when examining the same people over time (Skinner, 1989). Nevertheless, weight has been shown to increase during adulthood until about the age of fifty, with a gradual decline thereafter. Increases in body weight are usually a result of increases in body fat (Shephard, 1987b).

Body Mass Index (BMI) is perhaps a more acceptable interpretation of weight in relation to stature. In relation to skinfolds measurements, BMI can be used to help distinguish whether increases in mass are a result of increases in body fat or muscle mass. It is likely that an increase in BMI is due to increase in body fat for most middle aged people because results show that body fat increases with aging and is more pronounced in the middle age years (Government of Canada, 1981). Aging trends for BMI indicates that women tend to increase until 60-70 years of age compared with males who stabilize between 45 and 50 years of age. This information may be explained by a substantial increase in fat for women and a decrease in muscle mass for men (Frisancho, 1990, cited in Spirduso, 1995).

In contrast to weight, which levels off around the age of fifty, body fat continues to increase with age only levelling off around 65-70 years of age for women (Government of Canada, 1981). Men have a substantially less body fat compared with women and will generally level off around 45 years of age. Estimations of body fat, although in need of careful interpretation, have been linked to increased risk of cardiovascular disease (Going et al., 1994; Wood, 1994). The use of skinfolds measurements to estimate body fat have been criticised because measurement error has been shown to be higher in older adults due to redistribution of fat as aging occurs (Bouchard & Despres, 1989). Additionally, risk factors associated with excess levels of body fat appear to vary depending on the area of the body where the most fat is distributed. Measurements which indicate abdominal obesity carries a greater risk for disease than measurements indicating an excess of total body fat (Going et al., 1994; Government of Canada, 1987). In fact, the CSTF (Government of Canada, 1986) has recommended that taking skinfold measurements of waist to hip ratio and sum of two trunk skinfolds may be used to describe how the distribution of fat in certain areas of the body relates to health. As well, some evidence suggests that in order to effectively determine the health risk associated with obesity, the length of time one is obese should be accounted for (Going et al., 1994).

The Canada Fitness Survey (1981), has shown that women are more flexible than men. A decline in flexibility begins in both males and females as early as adolescence and continues throughout the lifespan. Loss of flexibility because of aging is, in part, due to decreased use of certain muscle groups (Spirduso, 1995). Some evidence has shown that less severe loss is seen in tests of trunk flexion than back extension. In one study, the anterior flexion of females was slightly better for participants who were middle aged as compared with those in their twenties (Einkauf, Gohdes, Jensen, & Jewell, 1987). This difference may be attributed to the fact that a larger proportion of the movements used in daily activities are geared more toward bending forward than bending backward. Flexibility is an important measure of physical fitness as it provides an indication of a joint strength and stability. Poor flexibility may be an indicator of age related diseases such as osteoarthritis. Little data are available describing changes in flexibility with increasing age. There is a need for more data on flexibility with age and how it affects individual functioning.

A distinction between muscular strength and muscular endurance must be made before describing these two components of physical fitness. Muscular endurance is the capacity to perform work repeatedly against a moderate resistance. Muscular strength is defined as the degree to which the muscular system can exert force in one contraction. It has been suggested that a relationship exists between muscular strength and muscular endurance: if muscular strength decreases then consequently, muscular endurance will also decrease (Buskirk and Segal, 1988). However, there does not appear to be a linear relationship between a decline in muscular strength and muscular endurance (Government of Canada, 1981). Muscular strength tends to increase until the thirties and then remain fairly constant until about age fifty with a marked decrease thereafter. In contrast, the muscular endurance of participants of the Canada Fitness Survey (1981) showed a steady decline throughout the age span. In particular, females showed less decline than males. This information is in direct contrast to studies which show that muscular endurance is maintained throughout aging, more effectively than muscular strength (Dummer, Clark, Vaccaro, Van Velden, Goldfare, & Sockler, 1985). The inconsistency of findings may be explained by the methods with which these two components of fitness were measured and the type of training the participants had undergone. Decline in strength has been shown to be more pronounced for the lower body than the upper body (Viitasala, Era, Leskinen, & Heikkinen, 1985). In fact some studies show little or no loss in strength when handgrip measurements are used (Colman, Plato, and Tobin cited in Spirduso, 1995). Dummer et al, (1985) showed that older women had similar strength as younger women who trained for the same amount of time but had lower endurance. As Spirduso (1995) explains, the findings may be clarified by the fact that swimming is an endurance activity and although the younger and older women swam for the same amount of time, the younger women swam for twice the distance as the older women. In effect, the younger women needed more muscular power to swim twice the distance in the same amount of time. Thus, although the information on muscular endurance and strength shows a steady and sometimes subtle decline as a result of aging, interpretations must be made considering the differences between measurement for different muscle groups and types of training regimes.

The state of cardiovascular fitness has been linked to health related risks such as ischaemic heart disease (Jette et al., 1992; Shephard, 1987a), consequently, cardiovascular fitness has been one of the most thoroughly examined areas in physical fitness research. In addition, cardiovascular fitness has been shown to be related to all-cause mortality (Blair, Kohl, Paffenbarger, Clark, Cooper, & Gibbons, 1989). Blair et al. (1989) assessed fitness by treadmill performance and followed the subjects for eight years. They found that mortality rates were lowest for those who were physically fit and highest for those who were unfit.

The decline in cardiovascular fitness due to aging is very hard to understand because, as Jackson et al. (1995) have demonstrated, participation in physical activity and changes in body composition influence the predictions of Maximum Oxygen Uptake (VO_{2max}) and thereby act as covariates to the effects of aging. Furthermore, depending on the type of measurement used, results for VO2max can vary. Direct measures appear to be the best method of determining oxygen uptake (Shephard, 1987a), but they are time consuming and expensive. Thus, numerous field tests have been developed to predict maximum oxygen uptake. Some criticism has been expressed when using field tests to predict VO2, especially in epidemiological studies, as they tend to under or over estimate the value of VO2 (Whaley, Kaminsky, Dwyer, & Getchell, 1995). Although direct measures of VO2max are considered the best measure of cardiovascular fitness, some field tests have been shown to be practical and reliable tools (Montgomery et al., 1982).

The Canadian Home Fitness Test (CHFT, 1986) is one field test which has been cited to have limitations since only a small percentage of the variance in calculating the predicted VO2max is directed toward the cardiovascular measure of post exercise heart rate (Shephard & Bouchard, 1993). As well, mechanical efficiency of stepping appears to be dependant on the ability of the participant to maintain a proper cadence (Seidl, 1986) and proven to be difficult for certain groups (ie. the elderly, disabled). Although numerous attempts have been made to modify the CHFT procedures, it has been shown to be a reliable estimator of VO2max compared with other common field tests (Montgomery et al., 1992).

The typical decline in cardiovascular fitness, as measured by maximal oxygen intake (VO2max), appears to be related to the decrease in maximum heart rate and in part by an age-related loss in muscle mass (Spirduso, 1995; Shephard, 1987b). Since most measures of VO2max are dependent on the ability of the muscles to use oxygen delivered by the lungs, VO2max is highly dependent on muscle mass. As well, some evidence shows that muscles become less effective at extracting oxygen from the blood as aging occurs (Shephard, 1987a). Because females lose a substantially higher amount of muscle mass and acquire more body fat than men, differences in the amount of work women can do as compared with men is substantially lower. Males have been shown to have VO2max values 10% higher than females throughout the middle age years (Government of Canada, 1981). One study examined the factors influencing a change in aerobic power in men aged 25-70 years (Jackson, Beard, Wier, Ross, Stutville, & Blair, 1995). Both longitudinal and cross-sectional data were used to determine age-related changes in aerobic power. The authors concluded that change in aerobic power were not only age-related, but due to the level of physical activity and percent body fat. Cross sectional designs have been criticised for being a weak measure of age-related changes in cardiovascular fitness because they represent estimates of changes in VO2max, as well, older participants who volunteer tend to be more physically fit than those who don't volunteer (Spirduso, 1995), however the strength of the study by Jackson et al. (1995), is that their longitudinal data supported their cross-sectional data. When examining cardiovascular fitness changes with aging, one must consider the interactive effects of level of physical activity, and percent body fat, as well as the methods used in the testing.

2.3 Physical Fitness of Persons with an Intellectual Disability

It is well documented that persons with an intellectual disability have substantially lower physical fitness performance when compared to the general population of persons without disabilities (Beasley, 1982; Fernhall & Tymeson, 1988; Montgomery et al, 1992; Moon & Renzaglia, 1982; Pitetti & Campbell, 1991; Pitetti & Tan, 1991; Reid et al. 1985; Schurrer, Weltman, & Brammel, 1985). Furthermore, females tend to perform more poorly than males on tests of cardiovascular fitness (Pitetti & Tan, 1991; Reid et al., 1985; Schurrer et al., 1985). The definition of intellectual disability in the DSM IV (1994) includes a list of deficits in adaptive functioning which are concurrent with the disability. Deficits range from communication and self-care to work and academic skills. Nowhere is it mentioned that there are deficits related to physical functioning. However, their is evidence that some differentiation in performance is based on the cause of intellectual disability. In their comparative study on growth, maturation, and performance, Beunen, Breugelmans, Lefevre, Maes, De Corte, & Claessens (1988) showed that children with a metabolic cause of intellectual disability (ie. Down's Syndrome, brain damage) had more severe growth delays than nonpathological (ie. functional, cultural, environmental) children with intellectual disability.

Although the evidence shows a link between physical performance and anthropometric differences, the factors affecting performance are too numerous to draw conclusions suggesting that low fitness is an inherent characteristic of intellectual disability. Montgomery et al. (1987), believe that poor physical fitness is more likely due to lack of opportunity in planning and participation in physical activities. In addition, problems with processing information and lack of ability to problem solve may have some effect on physical functioning (Bouffard & Wall, 1990). Seidl et al. (1987) suggested that many persons with an intellectual disability have shown poor gross motor control which can affect performance on physical fitness tests, resulting in lower measures of fitness. As previously mentioned, differences in somatic growth and biological maturation between persons with and without disabilities have been cited as having a strong influence on performance on physical fitness tests (Beunen et al., 1988; Shephard, 1993). This fact is important in light of the information which shows that persons with an intellectual disability have a smaller body size when compared to persons without disabilities (Reid et al., 1985). Even when corrections are made to control height and weight, boys with an intellectual disability have been shown to have poorer motor performance (Dobbins, Garron, & Rarick, 1981). However, other factors such as muscle weakness, lack of coordinated movement, and difficulty in understanding the concept of effort and speed may contribute to poorer performance (Dobbins et al., 1981; Fernhall, Tymeson, & Webster, 1988; Seidl et al., 1987; Tomporowski & Ellis, 1984). It is not yet clear to what extent internal or external factors, or a combination of both, contribute to a lower level of fitness.

In light of the fact that a number of persons with intellectual disability have additional medical conditions, it is important to note that drugs used to aid and/or control a physical or psychological condition can have an effect on one's physiological response to exercise (ACSM, 1995). For example, medication for thyroid conditions may increase heart rate and blood pressure during rest and exercise. Psychotropic medications, used to control anxiety, depression, and seizures, may result in an increase in heart rate and a decrease in blood pressure during rest and exercise. According to the ACSM (1995), these types of medications have no effect on exercise capacity, however their effect on heart rate and blood pressure are an important consideration when interpreting scores on tests of physical fitness using heart rate and blood pressure as factors in the calculation of physical performance.

Descriptive studies have generally focused on measures of cardiovascular fitness and obesity. One study, however, comprehensively described the physical fitness of 184 persons with an intellectual disability (Reid et al, 1985). They measured body composition, muscular strength and endurance, flexibility, and cardiovascular endurance of the group. The general conclusion was that the physical fitness of persons with an intellectual disability was inferior to the population of persons without disabilities. The differences in disability was inferior to the population of persons without disabilities. The differences in physical fitness was of varying magnitude for each component. This information suggests that research is needed to determine to what degree each variable contributes to total fitness.

Reid et al. (1985) established that persons with an intellectual disability were shorter than but similar in weight to non-disabled adults. Studies have shown that there is a prevalence of obesity for persons with an intellectual disability (Burkart, Fox, & Rotatori, 1985; Fox & Rotatori, 1982; Reid et al., 1985). Most findings show that females have a higher percentage of fat than males. As well, obesity tends to increase with age (Fox & Rotatori, 1982). Researchers use different measures to categorize their populations as being overweight. Height-weight tables and skinfolds measurements being the most common methods used to determine excess body weight in persons with an intellectual disability (Pitetti et al., 1993). BMI has also been used as a measure of excess fat. However, no information exists to determine the compatibility of these measures and accordingly, it is difficult to make comparisons among the different research studies which link obesity to risk factors such as heart disease and diabetes. Rimmer, Braddock, and Fujiura (1994) determined that the congruence between BMI, skinfolds and height-weight in populations with an intellectual disability is not strong. A number of false positive and negatives were found on each criteria for determining obesity. Since BMI does not discriminate between the proportion of fat to lean muscle mass, they recommend that BMI and skinfolds measurements be used to assess at risk status for excess weight. This information supports the suggestions of the CSTF Interpretation and Counselling Manual when determining the status of body composition (Government of Canada, 1987). Some limitations apply to using skinfolds measurements to determine body fat because of the training and skill involved in taking precise measurements (Rimmer & Kelly, 1987). Although Fox and Rotatori (1982) have established that obesity increases with age, to date there is no data to determine the combined effects of aging and level of physical activity on obesity in persons with an intellectual disability.

Muscular strength has been much more extensively researched than muscular endurance. Many people with an intellectual disability are involved in work that entails light to moderate levels of physical labour (Reid et al., 1985). Work performance is therefore dependent upon an adequate amount of strength and endurance. However, it is debatable whether they have adequate amounts of strength and endurance needed to accomplish most moderate physical tasks.

The majority of studies on muscular endurance and strength have been field studies. Measurements of sit-ups, push-ups, and hand grip are used as measurements of muscular endurance and strength in the CSTF (1981, 1986). These measures have been criticized because many persons with an intellectual disability obtain scores of zero. Thus, the measures become inaccurate in predicting potential capability (Horvat, Croce, & Roswel, 1993). Variable motivation and a lack of ability to exert maximum effort or force have also been cited as difficulties when assessing muscular strength and endurance (Pitetti, 1990; Seidl et al., 1987). In light of these concerns, Horvat, Croce, and Roswel (1993) established that a reliable measure of strength can be obtained using the mean of three trials when using a hand held device measuring the isometric muscle strength. They state, that due to the previously mentioned difficulties, the best score from several trials may not be representative of strength. These data question the reliability of the procedures for the hang grip test in the CSTF (1981, 1986) which uses the best score from two trials as a measure of muscular strength. In any event, field tests show that adults with an intellectual disability have very poor levels of muscular strength and endurance when compared to the general population (Reid et al., 1985). Similar findings for strength were obtained when using an isokinetic laboratory test (Cybex dynamometer) (Pitetti, 1990). The results indicated that persons with an intellectual disability had low arm and leg strength. The data on strength and endurance of persons with an intellectual disability is very limited and no data exists regarding aging effects.

With regard to flexibility, Reid et al. (1985), reported that both males and females (27th and 29th percentile respectively) with an intellectual disability had low performance on a sit and reach test. Flexibility appears to be an often overlooked component of fitness.

Sometimes, when studies have tested flexibility as part of a battery of tests, the performance results of flexibility are left out of the discussion section (i.e. Winnick & Short, 1991). Poor flexibility may inhibit a person from performing daily tasks involving bending and stretching and may contribute to injury when participating in physical activity (Government of Canada, 1987). Given the implications of poor flexibility, research in this area is sorely needed.

As mentioned in the previous section, cardiovascular endurance has been the most fully researched area in physical fitness and this also holds true for studies involving persons with an intellectual disability. Generally, field tests are used to predict VO2 in persons with a disability because of problems associated with having them perform at maximal levels (Fernhall, 1990). Seidl et al. (1987) expressed concern with using field tests because most have not been validated for persons with an intellectual disability. Since the time this concern was expressed, attempts have been made to validate field measures of VO2 for adults with an intellectual disability (Cressler, Lavay, & Giese, 1988; Montgomery et al., 1992). Cressler et al. (1988) determined that the Balke Ware Treadmill Test (R=.93) and a modified version of the Canadian Home Fitness Test (CHFT) (R=.95) yielded the highest reliability scores compared to the Cooper Twelve-Minute Run/Walk (R=.81) and the Physical Working Capacity Cycle Ergometry Test (R=.64). Similarly, in a study by Montgomery et al. (1992), the CHFT was determined to be the best measure of aerobic fitness over a submaximal cycle ergometer test and a maximal shuttle run test. Even though criticisms have been made with respect to the regression equation used to predict VO2max (Leger, 1984), modifications of the CHTF seem to be a reliable and efficient predictors of cardiovascular fitness for persons with an intellectual disability. It is important to note, that modifications of the testing procedure were deemed necessary by Reid et al. (1985), due to the participants' inability to maintain a desired stepping rate even after practice sessions were given. Reid et al. (1985) had to record "actual" rather than "recommended" stepping rates. This modification necessitated the use of interpolated values of the oxygen requirements provided by Jette et al. (1976) to predict VO2max.

Most studies have determined that persons with an intellectual disability exhibit much lower levels of performance on cardiovascular fitness tests when compared to persons without disabilities (Beasley, 1982; Fernhall & Tymeson, 1988; Montgomery et al., 1992; Pitetti & Campbell, 1991; Reid et al., 1985; Schurrer, Weltman, & Brammel, 1985). A paper by Pitetti and Campbell (1991), offers a striking testimony regarding the risks associated with poor cardiovascular fitness. They suggest that the low levels of cardiovascular fitness in persons with an intellectual disability are related to sedentary living conditions and associated accumulations of body fat which may lead to increased risk of cardiovascular disease. Social factors such as a lack of opportunity to participate in physical activities, overprotection of parents, and the caregivers lack of ability to provide for physical needs, further inhibit these persons from improving their fitness (Speakman, 1977).

Accurate measurement of cardiovascular fitness depends greatly on the understanding of the test item, motivation to perform the test, and familiarity with the exercise requirements for successful completion (Seidl, 1986). Tomporowski and Ellis (1984) have made several suggestions to ensure that persons with an intellectual disability are adequately prepared for tests. They suggest a combination of graduated guidance, modelling, and verbal instructions. Their subjects had better performance when using graduated guidance. Researchers must take special precautions to control for the many factors which may confound the results of a cardiovascular test. A shortcoming of the research on the cardiovascular fitness of persons with a disability is that no available data exists which illustrates the effects of aging on cardiovascular fitness.

Although descriptive studies have painted a bleak picture of the physical fitness characteristics of persons with an intellectual disability, training studies have shown that physical fitness can be improved using various modes of exercise. Caution must be made when interpreting the effects of training programs because of the failure to use valid and reliable tests of fitness (Pitetti et al., 1993). For example, improvements in performance of the training regime can be shown without a concomitant improvement in VO2max (Andrew, Reid, Beck, & McDonald, 1979; Millar, Fernhall, & Burkett, 1993). Andrew et al, (1979) used a treadmill protocol as their training regime and Millar et al. (1993) used a walk/run training program. Both studies used the treadmill for post training evaluation. The results of these studies imply that both laboratory and field training regimes can improve performance without significant changes in cardiovascular fitness. In contrast, two studies using a walk/jog program (Beasley, 1982; Schurrer et al., 1985) indicated improvements in cardiovascular fitness. Beasley used the 12 minute Copper walk/run to test Cardiovascular fitness and Schurrer et al. used a treadmill protocol to predict VO2max. Pitetti and Tan (1991) found a 16% increase in VO2max after 16 weeks of training on a cycle ergometer. Subjects were tested before and after on a treadmill and cycle ergometer, and although there was no control group, a 6 month follow-up showed that VO2max values had reverted back to their original values. It is interesting to mention that Pitetti and Tan (1991) had similar outcomes for the cycle ergometer and the treadmill on measures of physical fitness.

Problems may be encountered with the interpretation of results from fitness training programs. Failure to specify the duration and intensity of exercise (Pitetti & Campbell, 1991), weight reduction during the training program, and initial low levels of fitness may contribute to improvements in fitness training regimes for persons with a disability. Most studies which have used traditional group analyses have not accounted for the high variability in performance of the subjects with an intellectual disability. Seidl et al., (1987) suggested that due to the characteristic level of intra and inter-individual variability, traditional group designs measuring the effects of programming on physical fitness may be inadequate. Others have been strong supporters for the use of single subject designs and individual analyses to highlight and explain the nature of variable performance for persons with an intellectual disability (Bouffard, 1993; Watkinson & Wasson, 1984).

In summary, research in the area of fitness for persons with an intellectual disability has shown that they generally have lower levels of physical fitness than persons without disabilities. This low level of fitness is not likely due to some inherent characteristic but more likely to a sedentary lifestyle and a lack of opportunity to participate in recreational activities. However, low stature and poor motor control may have an effect on performance of physical fitness tests, overshadowing one's true potential. Training programs have been shown to improve fitness but adherence to these programs is difficult. Most importantly, research on the effects of aging on the physical fitness of persons with a disability is virtually nonexistent. In section 2.1 the risks associated with low levels of physical fitness were discussed. Pitetti and Campbell (1991) discuss these risks in relation to the information showing a low level of fitness in persons with an intellectual disability. They cite evidence establishing that persons with an intellectual disability have an earlier onset of physical old age and a higher mortality rate than the general population, that community dwellers have considerably more cardiovascular disorders than those in institutions, and that young adults with an intellectual disability have cardiovascular fitness levels indicative of a sedentary lifestyle. This evidence strongly suggests that persons with an intellectual disability have a faster rate of decline in physical fitness than the general population. Consequently, they recommend that future studies thoroughly investigate the effects of aging on physical fitness and determine whether the rate of physical fitness decline is of a greater magnitude than the non-disabled population. The need for this preliminary data is paramount to the understanding of the relationship between poor fitness and early onset of chronic disease. Additionally, if the decline in fitness is similar to the decline in persons without disabilities, and given the already low levels of physical fitness, the cardiovascular fitness of persons with an intellectual disability will be low enough to seriously prevent the average person from performing light work duties (Shephard, 1993). Consequently, as they become older, many will have to discontinue the type of work often available to them. Not to mention the decrease in their own quality and enjoyment of life, as well as, their ability to participate in the community with others through work activites. A loss of functional capacity would result in a loss of independence placing enormous burdens of responsibility on economic and health care services.

Chapter 3

Methodology

The purpose of this study was to describe the physical fitness characteristics of a group of adults with an intellectual disability and compare these results to their level of physical fitness 13 years ago. The methodology of this inquiry is described in the following sections: (3.1) Participant Selection, (3.2) Apparatus, (3.3) Procedures, (3.4) Control of Extraneous Variables (3.5) Training of Experimenter(s), (3.6) Treatment of the Data.

3.1 Participant Selection

Participants were selected from one readaptation center employing adults with an intellectual disability who participated in a previous study (Reid & Montgomery, 1983). The experimenter worked for six years at the readaptation center and was familiar with most participants. Fifty-six participants from a study examining the effects of a physical fitness program on workshop employees with an intellectual disability (Reid & Montgomery, 1983) were mailed a description of the present study with informed consent documents. Forty-eight participants responded to the mailing. Of the 48 who responded, 12 participants were screened out of the testing due to some type of physical disability. It is important to note that these 12 participants were able to perform the tests in 1983 but due to an acquired or degenerative disability were unable to participate in 1996. In addition, two participants refused to participate. Information about the participants who were screened out or refused to participate in the testing is contained in Table 2.

Thirty-four people passed the screening procedure (Physical Activity Readiness Questionnaire (rParQ), 1992) and agreed to participate by returning signed consent forms to the researcher. Of the 34 participants who agreed to participate in the study, 32 were able to complete the testing. The other two participants were unable to complete the testing due a lack of motivation. The participants had an age range between 34-57 years, with a mean age of 41.2 years. Of the 32 participants who completed the testing, 14 were females and 18 were males.

Table 2 **Reasons for Subjects not Participating in Study**

Reason for not Participating	# of subjects
Did not respond to request	9
Refused	1
Partial paralysis on one side of body	2
Wears brace on both legs for bad knees	1
Compressed vertebrae from a fall	1
Heart condition	1
Recently had epileptic seizures	1
Severe Arthritis and Osteoporosis	1
Hydrocephalic condition-uses a wheelchair	1
Hip replacement surgery	1
Muscular Dystrophy	1
Cystic Fibrosis	1
Back condition	1

The 32 adults with an intellectual disability were tested at either a day center which is part of the readaptation center or at their residence. Each of the participants had been selected for the 1983 study and were chosen at that time to meet the following criteria: (a) be between the ages of 20-39 years, (b) be employed by a training center, (c) be ambulatory and free from gross motor difficulties and medical conditions preventing participation in the exercise program, (e) not currently involved in regular exercise and (f) have signed consent to participate from a legal guardian. Participants selected for the current study met all of the above criteria with the exception of criteria (a), participants were now between the ages of 34 and 57, and criteria (e), as the focus of this study is on the current state of physical fitness regardless of involvement in physical activity. IQ scores were not available, however, these participants were classified as moderately to mildly intellectually disabled in the 1983 study (Montgomery, Reid, & Seidl, 1987).

Informed consent was obtained from each participant and their legal guardian prior to testing. In addition, approval was obtained from the Ethics Committee of the Faculty of Education, McGill University.

3.2 Apparatus

The Canadian Standardized Test of Fitness (CSTF) (Government of Canada, 1981) was administered during one session lasting approximately 1 hour. The testing battery measured five components of physical fitness: cardiovascular endurance, flexibility, body composition, muscular endurance and strength, and consisted of the following measures: (a)anthropometric measures of standing height and weight; (b) body-fat estimates from skinfolds measurements at the following sites: triceps, biceps, subscapular, and supra iliac; (c) strength measurement via a grip-strength score (sum of right and left grip); (d) muscular endurance measurements consisting of the number of sit-ups and push-ups performed; (e) flexibility measurement of trunk flexion; and (f) cardiovascular endurance measurements with a step-test protocol. The procedures outlined in the CSTF operations manual (Government of Canada, 1981) was employed for all tests with the exception of the Canada Home Fitness Test (CHFT). A modified version of the CHFT was recommended (Montgomery et al, 1985) as subjects with intellectual disability have been shown to experience difficulty maintaining the proper cadence when stepping.

Physical Fitness Variables

Anthropometric Variables

Anthropometric data collection followed the procedures outlined in the CSTF operations manual (1981) and included measurements of Height, Weight, Sum of Five Skinfolds measurements. Information about testing procedures and equipment used for these measurements may be found in Appendix A.

Muscular Strength and Endurance Variables

Muscular strength was evaluated using a hand-grip dynamometer to obtain a measurement of the sum of right and left hand grip strength. Muscular endurance was measured by number of sit-ups and push-ups. The procedures contained within the CSTF (Government of Canada, 1981) were employed for both measures. Information describing the testing procedures and equipment required may be found in Appendix B.

Flexibility Variable

Testing procedures outlined in the CSTF manual (Government of Canada, 1981) for the Sit and Reach Test were administered to measure the flexibility of each participant. Information regarding the equipment needed and testing procedures may be found in Appendix D.

Cardiovascular Endurance Variable

The procedure for the Canada Home Fitness Test (CHFT) from the CSTF Manual (Government of Canada, 1981) was modified for this study. The modification was necessary because "many participants experienced difficulty in attaining and maintaining the required stepping cadence" (Montgomery et al. 1987, p.75) recommended by the testing procedures. The results of the CHFT were placed into a regression equation provided by Jette, Campbell, Mongeon, and Routhier (1976) and used to predict VO_{2max}. The regression equation produced a correlation of 0.90 between the predicted VO_{2max} using the equation and a direct measure on a treadmill test with participants without a disability (Jette et al., 1976). In the 1983 study, the modified version of the CHFT was shown to be reliable with the regular version of the test producing a correlation of 0.84 (Montgomery et al., 1988). When compared to submaximal tests of cycle ergometry, shuttle test, and treadmill, Montgomery et al (1992) concluded that the optimal approach to predicting VO2max was via the use of the modified CHFT. The conclusion was based on test-rest reliability and validity relative to the treadmill test. Montgomery et al. (1992) used a modification of the regression equation used to predict VO2max and of the method of taking the final stage exercise heart rates. These modifications, although more reliable than the original procedures for the CHFT, were unable to be used in the present study because the comparative analysis necessitated the use of the exact protocol of Reid and Montgomery. (1983). Nonetheless, the CHFT appears to be a valid and reliable prediction of cardiovascular endurance. Appendix F offers information concerning the modified testing procedures and equipment used for the Canada Home Fitness Test.

3.3 Procedures

In accordance with the ACSM's Guidelines for Exercise Testing and Prescription (ACSM, 1995), a rPar-Q questionnaire was given to each participant prior to the testing day. The rPar-Q screened out any individuals who had risks associated with exercise testing (see Table 2). In addition to the Par-Q, information regarding medication was sought as the use of certain medications have an effect on exercise capacity (ACSM, 1995). In order to re-familiarize the participant with the tester, the tester visited each participant at his or her home. At this time, each participant was given a set of pretest instructions describing the testing and how to prepare for the testing day.

The testing for this investigation consisted of the items presented in the preceding section. Each participant was given the complete battery of tests during one testing session lasting approximately one hour. The sequence of the tests was administered as follows: 1) recording of anthropometric measures in the following order: weight, height, and skinfolds, 2) administration of hand grip strength, 3) administration of blood pressure and resting heart rate 4) administration of the Canada Home Fitness Test 5) administration of the remaining tests in the following order: push-ups, trunk flexion, and sit-ups. The above sequence has been recommended by the CSTF operations manual (Government of Canada, 1981) and has been chosen to reduce any error occurring with the skinfolds measurements which may be caused by body perspiration. Data sheets for each participant recorded personal information as well as the scores obtained for each test. The scoring sheet may be found in Appendix L.

3.4 Control of Extraneous Variables

All participants were asked to refrain from eating, drinking coffee, and smoking cigarettes two hours before the time of testing and not to exercise the day of the testing (ACSM, 1995). Explanation of each test, as well as, familiarization with the testing procedure, was made to each participant in an effort to reduce anxiety. This is extremely necessary since increases in heart rate can be provoked by anxiety and ingestion of narcotics (ie: caffeine and nicotine) or food (ACSM, 1995). Attention was given to the following prior to testing in an effort to help put the participants at ease: (1) participants were introduced to the tester(s) before the testing. Most participants have known the tester for six years prior to the testing; (2) testing equipment and procedures were fully described to each participant; (3) the temperature of the room was maintained at an appropriate temperature for exercising (68-72^{0}F); (4) the test room was decorated with posters and pictures, striving to minimize the impact of a sterile laboratory environment (Seidl, 1986); (5) a guardian of the participant was present to help ensure the participant was comfortable and relaxed.

Motivation has been cited to be a problem when testing persons with an intellectual disability (Seidl, et al., 1987). Therefore, in order to try and control for a potential lack of motivation, positive reinforcement through encouragement and praise was given throughout the testing for both successful and unsuccessful efforts made at completing the testing items. In order to remain consistent across participants, verbal encouragement (ie: well done, good job, you can do it, etc.) was given for every completion or attempt to complete a sit-up and push up. Verbal praise (ie: well done, excellent) was given at the completion of the sit and reach and hand grip tests. Verbal encouragement (step-up, step down, step-up, step-down) was given throughout the testing on the step test. In addition, the participant was given verbal praise every 30 seconds (well done, good job, excellent). Physical prompting and practice were needed for some participants who had difficulty learning the tests through solely verbal instructions.

3.5 Training of Experimenter(s)

An observer/assistant who has known the participants for 20 years was trained by the experimenter on all the tests used in this study. More specifically, the observer/assistant was trained to observe and count the number of ascents on the Canada Home Fitness Test, the number of sit-ups and push-ups, and measure the sit and reach test, as well as, observe the participants for any critical signs of physical stress which could have necessitated having the participant discontinue the test. A sphygmomanometer with built in microphone giving a digital readout of blood pressure and heart rate, was used for all participants and provided the consistency of measurement needed to obtain reliable data across participants.

3.6 Treatment of the Data

Raw scores from the five dependant measures were obtained, converted into percentile scores (CSTF Norms, 1981, 1986) placing each individual within a percentile ranking, and then compared to national averages contained within the CSTF operations manual (1981). Using the statistical program "Systat" descriptive statistics were obtained featuring the performance of each individual as well as the group.

Individual data helps to shed light on the individual nature of the performance of persons with an intellectual disability. It has been suggested and agreed upon (Bouffard, 1993; Watkinson & Wasson, 1984) that individual data may give a clearer picture of the performance of participants with an intellectual disability and is sometimes warranted when experimental groups are low in number and inter-individual variability is large.

The main interest of the study necessitated a more traditional statistical approach to analysing the data. In order to test the stated hypotheses, a 2-way time x group multivariate analysis of variance was performed. Five dependant variables representing components of physical fitness were used in the analysis. These dependant measures were cardiovascular endurance (VO_{2max}), muscular strength (hand grip strength), muscular endurance (push-ups and sit-ups), and flexibility (trunk flexion). To test for the magnitude of change in physical fitness over the 13 year period effect sizes for the sample were compared to effect sizes in the population. The population group is defined by special tabulations of the norms from the physical fitness tests employed in this study received from The Fitness and Lifestyle Research Institute (CSTF Norms, 1981).

Three levels of analysis are presented. First, individual data on each variable will be presented. As previously mentioned, it has been suggested that individual analysis may provide meaningful information about results when dealing with populations that have a high variability of performance (Bouffard, 1990, Watkinson & Wasson, 1984). Tables for each variable will list each participant's raw score and percentile score for his or her age group. Each participant is numbered and labelled according to gender (ie. 10F= participant 10 and female). Percentile scores were calculated by interpolating the values contained in the norms and percentile tables contained within the Canadian Standardized Test of Fitness Operations Manual (Government of Canada, 1981, 1986). Percentiles fall within each participant's age grouping and are not reflective of the effects of aging. Descriptive terms contained within the norms and percentiles tables will be used to categorize the state of physical fitness for a given variable.

Second, a repeated measures analysis of variance was performed for each variable to test the hypothesis that significant change was found in fitness between 1983 and 1996. Due to the large number of variables being measured on each participant, an omnibus test of significance was performed to protect for experiment-wise error. The omnibus test of significance resulted in significant differences for the following: a $p=0.000$ for the effect of measure, a $p=0.002$ for the effect of time, and a $p=0.000$ for the interaction time on all measures (see Table 3). Thomas and French (1990) state that if the variables show no association then they "could be considered independent (p. 262)" and accordingly, treated as such. If the variables are correlated, however, the alpha level should be adjusted for experiment-wise error (Glass & Hopkins, 1984). The results of the omnibus test of significance revealed that the dependent variable measures are independent of each other and therefore no adjustment of alpha is necessary (M. Hoover, personal communication, July, 1996).

Table 3 **Omnibus Test of Significance on 9 Dependant Measures**

BETWEEN SUBJECTS

SOURCE	S	DF	MS	F	P
GENDERS	1612.186	1	1612.186	6.156	0.021
ERROR	6023.815	23	261.905		

WITHIN SUBJECTS

SOURCE	S	DF	MS	F	P
Measure	792420.379	8	99052.547	694.509	0.000
Measure *GENDERS	7744.775	8	968.097	6.788	0.000
ERROR	26242.515	184	142.622		
Time	485.369	1	485.369	12.130	0.002
Time*GENDERS	191.153	1	191.153	4.777	0.039
ERROR	920.306	23	40.013		
Measure*Time	2348.676	8	293.585	11.860	0.000
Measure*Time *GENDERS	242.363	8	30.295	1.224	0.287
ERROR	4554.750	184	24.754		

Each dependent variable was also examined for gender effects. Gender differences for persons with an intellectual disability in physical fitness testing have been noted in previous studies (Pitetti & Tan, 1990, Reid et al, 1985). In addition, the norms and descriptive statistics from the Canada Fitness Survey (1981) are divided by gender. For the purposes of comparative analysis the data obtained were presented for both males and females. The results of the analysis of variance for each dependent variable will be presented in Table format.

Third, in order to test the magnitude of change in fitness for the sample as compared to the magnitude of change in the general population, calculation of effect sizes was computed. Weighted means and pooled standard deviations were used to calculate the effect sizes. Effect sizes will be presented in Table format for each variable measured in this study. Effect size calculations for the population were made possible with the use of descriptive statistics obtained from the Fitness and Lifestyle Research Institute, based on data taken from the Canada Fitness Survey (Government of Canada, 1981).

Interpretation of effect sizes will follow the suggestion of Thomas, Salazar, and Landers (1991) by using Cohen's (1988) categories for the interpretation of effect size. An effect size less than 0.41 will be considered small, from 0.41 to 0.70 moderate, and greater than 0.70 large. Moreover, small sample sizes may cause an effect size to become positively biased by 20% (Hedges, 1981). To obtain a virtually unbiased estimate of effect size a correction factor obtained with the following formula was multiplied by the sample effect size (Thomas & French, 1990):

$$c = 1 - \frac{3}{4(N_1+N_2-2)-9}$$

where: c = correction factor

N_1= sample size group #1

N_2= sample size group #2

Chapter 4
Results

The purpose of this study was to describe the physical fitness of middle-aged adults (34-54 yrs) with an intellectual disability and how their fitness has changed over time. Chapter 4 will provide results from data collection of nine dependant variables and will be organized in the following manner: (4.1) Reliability, (4.2) Anthropometric Measures, (4.3) Muscular Strength, Endurance and Flexibility; (4.4) Cardiovascular Endurance.

4.1 Reliability

A one-way Random ANOVA Model (Safrit, 1976) was used to calculate intra-class correlation scores for stability of all variables. The scores are as follows: Maximum Oxygen Uptake (VO2max) (.98), Height (.99), Weight (.99), Percent Body Fat (.98), Sit-ups (.93), Push-ups (.80), Hand Grip Strength (.98), Flexibility (.85). The data collected appear to be reliable as the intraclass correlation scores are high (Glass & Hopkins, 1984).

4.2 Analysis of Anthropometric Variables

The individual results for the anthropometric measures of height, weight, body mass index, percent body fat can be found in Table 4. In interpreting the percentile values, it should be remembered that percentile scores are ranked according to the age of the participants. An increase or decrease in physical fitness measurement is a normal part of the aging process. Therefore, if an individual increases or decreases at the expected pattern, percentile scores should not markedly change. Percentile scores that change dramatically may be an indication of decline or improvement in fitness beyond the expected changes due to aging in comparison to peers.

Table 4 Anthropometric Individual Results

Subject #Sex	Age	Year	Height (cm)* Score	Height (cm)* %ile	Weight (kg)* Score	Weight (kg)* %ile	Body Mass Index Score	Body Mass Index %ile	Body Fat(%) Score	Body Fat(%) %ile
1M	24	1983	167.3	23.3	70.5	42.5	25.2	29	22.6	17.3
	37	1996	166.4	23.5	73.9	42.3	26.7	31.5	20.8	52
2M	28	1983	179.7	61.8	95	94.3	29.4	6.5	29.1	2.7
	41	1996	177.2	65.5	73.9	37.3	23.5	77.5	25.5	37.5
3M	41	1983	162.6	13.0	57.5	0	21.7	95	20.1	80
	54	1996	160.0	0	51.7	0	20.2	95	17.7	96.4
4M	24	1983	162.9	9.8	64.7	19.3	24.4	38	19.2	37.5
	37	1996	161.3	6.5	79.4	61	30.5	8.8	29.4	3.2
5M	38	1983	146.7	0	55.9	0	26	35	25.8	10
	51	1996	142.9	0	47.9	0	23.5	87.5	27.5	35
6M	22	1983	168.7	28.5	56.8	4.8	20	90	9.3	100
	35	1996	166.4	23.5	54	0	19.5	95	20	61
7M	22	1983	162.3	8.3	57.3	5.4	21.8	76	18.4	44.2
	35	1996	160.0	0	59.4	6.8	23.2	69	25	13.8

Table 4 (continued)

Subject #Sex	Age	Year	Height (cm)* Score	Height (cm)* %ile	Weight (kg)* Score	Weight (kg)* %ile	Body Mass Index Score	Body Mass Index %ile	Body Fat(%) Score	Body Fat(%) %ile
8M	22	1983	181.6	68.0	80.8	76.3	24.5	37.5	17.0	56.7
	35	1996	180.3	68.3	78.0	55	24.0	55	16.3	89.2
9M	26	1983	177.5	56.3	90.5	91.1	28.7	8.3	-	-
	38	1996	176.5	58.3	99.3	94.4	31.9	5.3	31.0	2.2
10M	23	1983	164.7	14.3	65.4	22.0	24.3	38.5	19.0	39.2
	36	1996	164.5	17.5	74.8	44.5	27.6	27.0	25.6	11.3
11M	34	1983	176.5	55	62.4	10.7	20.0	95	21.9	40.0
	47	1996	174.0	55	63.0	8.8	20.8	100	24.4	47.5
12M	21	1983	152.1	0	47.0	0	20.3	96.5	20.1	30.0
	34	1996	151.1	0	59.9	7.4	26.2	34.0	30.9	2.2
13M	22	1983	178.4	60.0	69.1	35.5	21.7	76.5	20.1	30.0
	35	1996	179.1	65.3	88.5	83.8	27.6	27.0	32.1	1.4
14M	44	1983	178.6	69.0	70.3	25.8	22.0	90	15.5	98.8
	57	1996	174.0	57.5	70.3	25.8	23.2	84	18.6	95.6

Table 4 (continued)

			Height (cm)*		Weight (kg)*		Body Mass Index		Body Fat(%)	
Subject			Score	%ile	Score	%ile	Score	%ile	Score	%ile
#Sex	Age	Year								
15M	26	1983	168.3	26.5	63.6	16.5	22.2	62.5	13.6	84.3
	39	1996	167.6	28.0	77.1	52.8	22.5	27.5	29.0	3.5
16M	39	1983	148.6	0	50.5	0	22.9	75.5	12.7	97.7
	52	1996	149.9	0	49.9	0	22.2	89.0	13.3	100
17M	24	1983	160.7	4.0	63.7	16.8	24.6	37.0	19.8	32.5
	37	1996	156.2	0	72.1	35.5	29.6	12.0	29.7	3.0
18M	23	1983	141.6	0	41.8	0	20.9	85.5	16.7	59.2
	36	1996	138.4	0	45.4	0	23.7	66.5	22.6	32.5
1F	21	1983	161.3	43.0	66.4	85.7	25.5	12.5	30.7	2.2
	34	1996	160.0	42.5	69.9	82.3	27.3	14.3	32	2.5
2F	24	1983	157.8	32.0	62.7	78.5	25.2	14	34.9	0
	37	1996	153.7	24.3	72.6	86.6	30.7	1.5	41.3	0
3F	32	1983	149.6	14.0	38.6	0	17.2	95	24.7	26.7
	45	1996	147.3	8.3	43.1	0	21.6	72	35.1	1

Table 4 (continued)

Subject #Sex	Age	Year	Height (cm)* Score	%ile	Weight (kg)* Score	%ile	Body Mass Index Score	%ile	Body Fat(%) Score	%ile
4F	33	1983	161.3	46.5	63.5	67.5	24.4	28	31.6	2.8
	46	1996	159.4	41.0	64	57.5	25.2	34	33.3	2.5
5F	32	1983	147.6	9	52	17.5	23.9	35.5	-	-
	45	1996	144.2	0	52.8	14.5	25.4	33	41.9	0
6F	33	1983	145.4	0	41.8	0	19.8	95	25.7	19.4
	46	1996	144.9	0	59	40	28.1	19.5	42.5	0
7F	34	1983	133.4	0	80.9	94.1	45.5	0	-	-
	47	1996	130.8	0	72.1	81.4	42.1	0	41.4	0
8F	30	1983	153.7	24.3	54.1	25.5	22.9	50.5	32.4	2.2
	43	1996	152.4	21.0	64.9	59.8	27.9	20.5	38.0	0
9F	38	1983	155.6	29.0	43.8	0	18.1	95	20.6	63.3
	51	1996	157.5	42.5	40.8	0	16.5	95	24.5	50.8
10F	22	1983	144.3	0	53.9	39.5	25.9	10.5	35.6	0
	35	1996	143.5	0	63.5	67.5	30.8	5.5	42.4	0

Table 4 (continued)

Subject #Sex	Age	Year	Height (cm)* Score	Height (cm)* %ile	Weight (kg)* Score	Weight (kg)* %ile	Body Mass Index Score	Body Mass Index %ile	Body Fat(%) Score	Body Fat(%) %ile
11F	24	1983	179.7	100	78.1	67.8	24.2	19.0	-	-
	37	1996	178.4	100	84.8	74.5	26.6	17.0	39.3	0
12F	31	1983	162.6	51.0	66.2	73.7	25.0	25.0	35.2	0
	43	1996	157.5	33.8	64.4	58.5	26.0	30.0	38.4	0
13F	24	1983	156.0	27.5	56	50.0	23.0	25.0	27.7	5.5
	36	1996	155.6	29.0	60.8	59.0	25.1	24.5	36.7	0
14F	23	1983	162.9	49.5	55.2	46.0	20.8	61	27.0	9.0
	36	1996	164.5	57.5	67.6	76.5	25.0	25	36.6	0

*Norms for Height and weight from CSTF-Operations Manual, 1986.

All other variables are taken from CSTF-Operations Manual, 1981.

4.2.1 Height

The group results for height found in Table 5 for males and females, indicate that the persons with an intellectual disability in this study can be described as having "Below Average" height in comparison to the persons without disabilities (CSTF, 1986). The males had a mean percentile score of 27.7 in 1983 and 30.4% in 1996. Females had mean percentile score of 26.3 in 1983 and 28.6 in 1996. This is consistent with findings from other studies which identify persons with intellectual disabilities as having shorter stature than the general population (Reid et al., 1985; Shephard, 1993).

Of the fourteen female participants, nine were considered to have "Below Average" height, four participants were "Average" height, and one participant was "Above Average". The recorded measures in height between 1983 and 1996 for three females indicate a jump into a higher or lower category. Participant 9F and 14F had an increase in height and participant 12F a decrease in height of 5.1 cm. All male participants remained within the same descriptive category according to their age as in 1983. The large magnitude of difference for the three female participants may be due to experimenter error between the testers in 1983 and 1996. However, some evidence suggests that females lose height at a faster rate than males (Spirduso, 1995). This height decline in females may be attributed to the fact that they reach their peak height at an earlier age than men and that many develop osteoporosis. This is discussed further in Chapter 5.

Table 5 presents the results of a repeated measures analysis of variance for height including males and females.

Table 5 <u>Repeated Measures ANOVA and Descriptive Results for Height</u>

Effect	df	MS	F	p
BETWEEN SUBJECTS				
Gender	1	1656.259	5.960	0.021
Error	28	277.895		
WITHIN SUBJECTS				
Time	1	44.674	28.36	0.000
Timex gender	1	0.350	0.222	0.641
Error	30	1.575		

DESCRIPTIVE RESULTS

	YEAR					
	1983			1996		
	Mean	SD	%ile	Mean	SD	%ile
Females	155.1	11	26.3	153.6	11.3	28.6
Males	165.2	12.2	27.7	163.7	12.4	30.4

Both males and females experienced significant change in height over time. This finding is common as the difference in means between this sample and the data taken from the Canada Fitness Survey (1981) are fairly similar. Table 6 indicates that small effect sizes were found for both the males and females with intellectual disabilities (males= .15; females=.14). Although the analysis of variance indicates that the change in height over time is significant, the magnitude of change for height is actually small and remains consistent with the effect sizes of the population.

Table 6 **Comparison of Effect Sizes for Height**

GROUP	Population ES	Sample ES
Male	-.11	-.15
Female	-.09	-.14

4.2.2 Weight

Table 4 presents the individual results for weight of each participant. Both male and female participants are described as having "Below Average" weight in 1983 and "Average" weight in 1996 (CSTF manual, 1986). A move from "Below Average" to "Average" indicates an increase in weight.

In 1983, five female participants were described as having "Above Average" weight, two were "Average" and, five were described "Below Average". In 1996, five female participants were "Above Average", six were of "Average" weight and, three were described as "Below Average". Of the fourteen female participants, four gained enough weight to move them up one descriptive category and one female participant moved up two categories. Two female participants lost weight, one moved down a category and the other remained in the same category.

Table 7 profiles the results of the repeated measures analysis for weight.

Table 7 Repeated Measures ANOVA and Descriptive Results for Weight

ANOVA RESULTS

EFFECT	df	MS	F	p
BETWEEN SUBJECTS				
Gender	1	463.736	1.522	0.227
Error	30	304.613		
WITHIN SUBJECTS				
Time	1	214.878	5.888	0.021
TimexGender	1	19.030	0.521	0.476
Error	30	36.492		

DESCR IPTIVE RESULTS

	YEAR					
	1996			1983		
	Mean	SD	%ile	Mean	SD	%ile
Females	58.1	12.5	34.2	62.9	11.6	54.2
Males	64.6	13.8	25.6	67.7	14.8	46.0

The means indicate that both the males and female groups gained weight over the two testing sessions. Interestingly, one participant in particular lost 21.1 kg., illustrating the variable nature of the raw data scores. Of the females, two participants lost weight over the two testing sessions, however, these weight loses were minimal in comparison with the males. Participants had a significant effect of time. Males and females were not significantly different from each other and no interaction was found.

Table 8 contains information relating to the magnitude of difference in weight change as compared to the population.

Table 8 **Comparison of Effect Sizes (ES) for Weight**

	Population ES	**Sample ES**
Male	**.14**	**.22**
Female	**.26**	**.39**

Males with an Intellectual Disability had an effect size of 0.22 as compared to the effect size of 0.14 for the population. Both may be considered to be representative of small changes in weight. When compared to the small effect size of the female population, the female group approached a medium effect size of .40.

4.2.3 Body Mass Index

Body Mass Index (BMI) has been identified as one method of determining the proportional weight of the person(s) being tested. However, one must exercise caution in using this measure, since an increase in BMI may be the result of either excessive body fat content or an increase in muscle mass. In order to determine the cause of an increase in BMI one may consider the Sum of Skinfolds (SOS). If the SOS is also high, then an excess of body fat is the logical cause of the increased BMI (CSTF, 1986).

Table 4 presents the individual data for Body Mass Index (BMI) and Table 9 provides the group, male and female results. A significant effect was found for time ($p=0.001$). Nonsignificant effects were found for gender and the interaction. The females percentile ranking for 1983 was 40.4 and 28.0 in 1996. These rankings indicate that the females have a "Below Average" measure of body mass index. The males remained fairly consistent over time with a mean percentile of 59.6 in 1983 and 55.1 in 1996. Their rankings indicate an "Average" height-weight ratio. The individual data appears to describe the variability among participants and perhaps illustrate more precisely the changes associated with age for BMI.

In this study, both males and female groups demonstrated significant change in BMI from 1983 to 1996. Since both groups also have significant increases in percent body fat, the results for BMI may be interpreted to be the result of an excess of body fat for both genders.

Table 9 **Repeated Measures ANOVA and Descriptive Results for Body Mass Index**

EFFECT	df	MS	F	p
BETWEEN SUBJECTS				
Gender	1	34.095	0.863	0.360
Error	30	39.495		
WITHIN SUBJECTS				
Time	1	73.713	14.537	0.001
TimexGender	1	3.546	0.699	0.410
Error	30	5.071		

DESCRIPTIVE RESULTS

	YEAR					
	1983			1996		
	Mean	SD	%ile	Mean	SD	%ile
Females	24.4	6.7	40.4	27.0	5.6	28.0
Males	23.4	2.8	59.6	25.1	3.6	55.1

Table 10 outlines the effect sizes in BMI for both the population and the sample. Both males and females had moderate changes in BMI compared with small changes expected for the population.

Table 10 **Comparison of Effect Sizes for BMI**

GROUP	Population ES	Sample ES
Male	.23	.52
Female	.31	.42

4.2.4 Percent Body Fat

As mentioned earlier, BMI and percent body fat, viewed together, give a clearer picture of body adiposity. If a person has a high or low BMI, calculation of percent body fat can determine whether a high or low BMI is associated with fat content (CSTF, 1986). The group results found in Table 11 indicate that males had an "Average" amount of body fat in 1983 (mean percentile= 59.6) and an "Above Average" amount of body fat in 1996 (mean percentile= 38.2) (CSTF, 1981). Females are described as "Obese" in terms of body fat in both 1983 (Mean percentile = 11.9) and 1996 (mean percentile=4.1). (CSTF, 1981). Increases in body fat are a normal part of aging. However, some individual results indicate changes in body fat are of a greater magnitude than would be expected through aging. The following paragraph will describe these changes.

In 1983, eight females were described as "Obese", two as having "Above Average" body fat, and one as having an "Average" amount of body fat. In 1996, ten females were described as "Obese" and, one female as having an "Average" amount of body fat. Two of the women increased their body fat from "Above Average" to "Obese" (F3, F6) between 1983 and 1996, all other women except for one remained categorised as "Obese" in 1983 and 1996.

In 1983, one male was described as "Obese", five as having "Above Average" body fat, six as having "Average" body fat, two were described as having ideal body fat and three were described as "Slim" (CSTF, 1981). In 1996, 7 males were described as "Obese", two as having "Above Average" body fat, five as "Average", three as "Ideal", and one as "Slim". Of the males measured in this study, ten had increases in body fat to the extent where their description changed. Some dramatic increases were recorded as in the case of participant M15 whose increase in body fat resulted in a change of ranking from "Ideal" body fat to "Obese". Interestingly, five male participants had decreases in body fat, resulting in a change of their descriptive ranking to a more positive status.

Table 11 **Repeated Measures ANOVA and Descriptive Results for Percent Body Fat**

EFFECT	df	MS	F	p
BETWEEN SUBJECTS				
Gender	1	1792.833	46.915	0.000
Error	26	38.214		
WITHIN SUBJECTS				
Time	1	478.221	34.086	0.000
TimexGender	1	8.904	0.635	0.433
Error	26	14.030		

DESCRIPTIVE RESULTS

	YEAR					
	1983			1996		
	Mean	SD	%ile	Mean	SD	%ile
Females	29.6	4.9	11.9	37.4	5.0	4.1
Males	18.9	4.7	50.6	24.4	5.6	38.2

Reporting the skinfolds thickness is now considered a more accurate measure of body fat. The equation used to predict percent body fat has been shown to be subject to error (CSTF, 1986). In this study, estimates of body fat are reported in terms of percentages. Even though it is suggested that the sum of skinfolds measurements may be more accurate predictors of body fatness, the researcher had to report the results in percentages as was done in 1983. For the purposes of comparison, percentages are the most appropriate measures to be used for this study.

The results of the repeated measures ANOVA in Table 11shows that significant differences were found for the main effect of gender and time. The means indicate that the females had a significantly greater increase in percent body fat than the males. In 1983 (Montgomery & Reid), the trained graduate students were unable to obtain skinfolds measures for three female participants. The significant changes in both percent body fat and BMI demonstrate that the participants in this study have had significant increases in body adiposity over the 13 year period.

Table 12 contains the results from the calculation of effect sizes depicting the magnitude of change in percent body fat over 13 years. The effect sizes for both male and female members of the population can be described as "Small". The effect sizes for both male and female participants can be described as "Large". This information suggests that the body fat content of persons with a disability in this study is an area of concern, since the change is much larger than what would be expected in the general population.

Table 12 **Comparison of Effect Sizes for Percent Body Fat**

GROUP	Population ES	Sample ES
Male	**.13**	**1.05**
Female	**.28**	**1.50**

4.3 Muscular Endurance and Strength

4.3.1 Grip Strength

The group results for Grip Strength are contained within Table 13 and the individual results for males and females are included in Table 14. The group data indicates that both male and female participants improved their hand grip strength. The analysis of variance indicates that these changes were significant. The significant increase in grip strength is contrary to patterns of changes in strength as people age (Government of Canada, 1982; Spirduso, 1995). The instrument used for grip strength in 1996 was one of six identical instruments used to record data in 1983. The hand grip dynamometer used in 1996 was calibrated with a 9-kg weight. Moreover, an intra-class correlation coefficient of .98 was obtained during retesting of 10 participants in the 1996 portion of the study. The unexpected difference in scores from 1983 to 1996 are difficult to explain as no records of calibration or reliability measures between the hand grip dynamometers used in 1983 are available. Explanations for the differences in measurements may be due to variability in performance which is typical in populations with intellectual disabilities (Seidl et al, 1987) and possibly due to fluctuations in motivation or some form of measurement error. Since the significant increase in strength over 13 years is contrary to expectations, no further discussion will take place with respect to Grip Strength. One point of interest is that although the percentile scores increased for both males (1983= 3.4; 1996= 12.6) and females (1983= 1.7; 1996= 16.3) both groups still are described as having "Poor" performance of grip strength (Government of Canada, 1981).

Table 13 **Repeated Measures ANOVA and Descriptive Results for Grip Strength**

EFFECT	df	MS	F	p
BETWEEN SUBJECTS				
Gender	1	11294.867	17.172	0.000
Error	30	657.768		
WITHIN SUBJECTS				
Time	1	3356.175	56.508	0.000
TimexGender	1	201.966	3.400	0.075
Error	30	59.393		

DESCRIPTIVE RESULTS

	YEAR					
	1983			1996		
	Mean	SD	%ile	Mean	SD	%ile
Females	17.9	11.9	1.7	36.1	12.9	16.3
Males	48.3	21.0	3.4	59.3	24.4	12.6

Table 14 **Muscular Endurance, Muscular Strength, and Flexibility (individual Results)**

			Hand Grip (kg)		Push-Ups (no.)		Sit-Ups(no in 60sec)		Flexibility (cm)	
Subject #Sex	Age	Year	Score	%ile	Score	%ile	Score	%ile	Score	%ile
1M	24	1983	43	0	10	12.5	0	0	31	52.5
	37	1996	44	0	10	17.5	13	3.6	34	66.3
2M	28	1983	59.0	2.1	20	37.5	0	0	23.0	18.8
	41	1996	74.0	18.3	20	70.0	0	0	21.5	26.7
3M	41	1983	52	1.0	20	70.0	8	3	25.2	41.0
	54	1996	51	2.0	10	35.0	14	20	32.5	78.3
4M	24	1983	36.0	0	14	20	16	2.9	34.4	67.0
	37	1996	43.5	0	19	50	8	1.4	16.0	8.0
5M	38	1983	48.0	0	15	32.5	0	0	33.5	70.0
	51	1996	41.5	0	16	65.0	0	0	34.5	83.8
6M	22	1983	45.0	0	10	12.5	7	0	26	30.0
	35	1996	60.5	2.3	28	82.5	16	5	8	2.3
7M	22	1983	51.5	0.4	24	52.5	20	4.6	28.0	38.3
	35	1996	63.5	3.0	15	32.5	0	0	22.5	23.1
8M	22	1983	85.0	23.3	21	40	20	4.6	14.5	4.1
	35	1996	108.5	77.5	11	25	27	40.0	20.0	15.0
9M	26	1983	84	21.7	20	37.5	50	95.4	5.3	0.1
	38	1996	120	92.5	18	45.0	25	30.0	16.5	4.0
10M	23	1983	51.2	0.3	10	12.5	10	0.4	25	25
	36	1996	39.5	0	7	11.7	8	1.4	41	90

Table 14 (continued)

Subject #Sex	Age	Year	Hand Grip (kg) Score	%ile	Push-Ups (no.) Score	%ile	Sit-Ups(no in 60sec) Score	%ile	Flexibility (cm) Score	%ile
11M	34	1983	70	4.5	7	11.7	14	4.1	11.0	3.5
	47	1996	60	2.9	0	0	0	0	16.5	13.3
12M	21	1983	11.5	0	11	13.8	2	0	8	1.3
	34	1996	39.5	0	7	11.7	0	0	7	1.9
13M	22	1983	39	0	6	5	10	0.4	14.5	4.1
	35	1996	53	0.5	0	0	8	1.4	20.5	16.7
14M	44	1983	53	1.2	4	7.5	14	10.0	27	50
	57	1996	63	5.0	3	11.7	1	0.6	20	30
15M	26	1983	72.5	6.9	19	35.0	10	0.4	23	18.8
	39	1996	86.0	23.3	8	13.3	0	0	17	10.0
16M	39	1983	22.0	0	9	15	0	0	18	11.7
	52	1996	28.5	0	15	60	8	5	21	33.3
17M	24	1983	19	0	0	0	0	0	24.0	23.3
	37	1996	47	0	0	0	0	0	31.5	61.7
18M	23	1983	27.5	0	30	72.5	30	32.5	41	88.3
	36	1996	44.5	0	24	70.0	18	10.0	40	85.0
1F	21	1983	12.5	0	0	0	0	0	23.0	15.0
	34	1996	38.0	6.7	-	-	0	0	30.5	46.7
2F	24	1983	42.0	15.0	15	40	10	4.1	27.2	29.0
	37	1996	65.5	86.9	12	35	0	0	22.5	15.0

Table 14 (continued)

Subject #Sex	Age	Year	Hand Grip (kg) Score	%ile	Push-Ups (no.) Score	%ile	Sit-Ups(no in 60sec) Score	%ile	Flexibility (cm) Score	%ile
3F	32	1983	12.5	0	10	30	10	13.3	24.5	21.3
	45	1996	24.5	2.2	15	45	7	12.5	23.5	22.5
4F	33	1983	29.0	1.9	8	22.5	19	45	28.5	37.5
	46	1996	44.5	23.8	9	30.0	0	0	21.0	15.0
5F	32	1983	2	0	0	0	4	2.9	29.0	40.0
	45	1996	24	2	6	20	5	7.5	22.0	18.3
6F	33	1983	12.0	0	4	13.3	9	10	21.2	12.4
	46	1996	31.5	4.5	18	72.5	0	0	45.5	95.2
7F	34	1983	7.5	0	40	97.9	4	2.9	23.2	17.3
	47	1996	19.0	0.3	19	75.0	0	0	42.5	90.0
8F	30	1983	9.5	0	8	22.5	10	11.7	7.0	0.4
	43	1996	28	3.3	18	72.5	13	35.0	22.5	20.0
9F	38	1983	37	5	32	95.0	18	40	30.5	46.7
	51	1996	42	21.7	17	80.0	13	55	30.0	50.0
10F	22	1983	13.0	0	10	22.5	30	70.0	25.6	23.0
	35	1996	30.5	2.5	-	-	11	13.3	27.5	32.5
11F	24	1983	28	2.1	13	32.5	10	4.1	9	1.0
	37	1996	54	50	12	35.0	14	22.5	20	10.0
12F	31	1983	8.0	0	3	11.7	4	2.9	20.5	11.0
	43	1996	33.5	5.8	11	40.0	0	0	20.0	13.3

Table 14 (continued)

Subject #Sex	Age	Year	Hand Grip (kg) Score	%ile	Push-Ups (no.) Score	%ile	Sit-Ups(no in 60sec) Score	%ile	Flexibility (cm) Score	%ile
13F	24	1983	21	0	13	32.5	10	4.1	4.2	0
	36	1996	44	17.5	12	35.0	10	11.7	14.0	3.5
14F	23	1983	17.0	0	8	15.0	10	4.1	24	17.5
	36	1996	26.5	1.0	9	47.5	8	7.5	25	22.5

Percentiles taken from CSTF. 1981

4.3.2 Push-Ups

Push-ups are considered a measure of muscular endurance (CSTF, 1981). Performance of the maximum number of push-ups can be described as "Below Minimum" for males in both 1983 and 1996. Females can be described as performing a "Minimum" number of pushups in both 1983 and 1996. All male participants were able to complete this test, however; in 1996, three male participants scored 0 on this measure as they were only able to perform pushups from their knees. In the 1996 phase of the study, two females were unable to learn how to perform the pushups according to the procedures outlined in Appendix C.

The individual results for pushups from 1983 show that one male participant was described as having "Poor" performance, eight are described as "Below Minimum", seven as "Minimum", and one as "Good". In 1996, three participants were described as having "Poor" performance, seven as "Below Minimum", five as "Minimum", and one as "Good". Of the 18 male participants, six performed poorer in 1996 compared to 1983 resulting in a change in their descriptive category. Two participants had improved scores also resulting in a change of their descriptive category. The females appeared to perform better than the males in terms of their level of performance in pushups. In 1983, six females had a "Below Minimum" performance as opposed to three in 1996. Four female participants are described as "Minimum" compared to five in 1996. One participant was described as "Good" in 1983 compared to four participants falling into this category in 1996. One participant is described as excellent of pushups in 1996. Of the 13 female participants who performed the push-up test, one female reduced her push-up total to drop one descriptive category and five participants improved to increase their descriptive category.

Table 15 outlines the results of a repeated measures ANOVA for the variable of maximum number of pushups. Non-significant differences were found for the main effects of gender and time.

Table 15 **Repeated Measures ANOVA and Descriptive Results for Pushups**

EFFECT	df	MS	F	p
BETWEEN SUBJECTS				
Gender	1	0.136	0.001	0.970
Error	28	94.584		
WITHIN SUBJECTS				
Time	1	27.225	0.620	0.438
TimexGender	1	13.225	0.301	0.588
Error	28	43.945		

DESCRIPTIVE RESULTS

	YEAR					
	1983			1996		
	Mean	SD	%ile	Mean	SD	%ile
Females	11.7	11.4	31.3	12.4	3.9	49.0
Males	13.9	7.8	27.1	11.6	8.3	33.4

Table 16 highlights effect sizes for the number of pushups performed. Although males from both the population and sample are reported to have small effect sizes, the sample of males are shown to have a smaller effect of aging on pushups performance compared to the general population. The population and sample of females had small effect sizes. Note, however, that the women's performances improved 1996, as reflected by the positive effect size value of 0.8.

Table 16 **Comparison of Effect Sizes for Pushups**

GROUP	Population ES	Sample ES
Male	-.40	-.28
Female	-.15	.08

4.3.3 Situps

Table 17 contains the group results for the number of situps performed in 60 seconds. In general, the percentiles for 1983 and 1996 for both males and females would describe the participants as having poor performance (CSTF, 1981). Eight male participants were unable to perform a single sit-up within the 60-second time limit in 1996. In 1983, five male participants were unable to perform a single situp. In 1983, 13 male participants were described as "Poor", four as "Below Minimum", one as "Minimum", and one as having "Good" performance. In 1996, 12 male participants are described as having "Poor" performance, five as "Below Minimum", and one as "Minimum". Of the 18 males, five decreased enough to lower their categorical description. Four moved to a more favourable description. Six female participants in 1996 and one in 1983 were unable to perform a single situp. In 1983, eight women were described as having "Poor" fitness, three as "Below Minimum", and three as "Minimum". In 1996, six were described as "Poor, six as "Below Minimum", and two as "Minimum" number of situps. With regard to descriptive category, three females decreased and five increased. Situps, as a measure of muscular endurance, appears to be an area of weakness for the persons in this study.

Table 16 depicts the results for the muscular endurance of the variable situps. Participants showed a significant decline in the number of situps performed.

Table 18 depicts the results of effect size calculation to measure the magnitude of change in performance for situps. The results indicate that the males were fairly representative of the change found within the population. Both the sample and the population of males had medium effect sizes. The females in this study had a medium effect size of .69 compared with the population's effect size of .23 which may be considered small. These data for females indicate a greater change than would be expected.

Table 17 Repeated Measures ANOVA and Descriptive Results for Situps

EFFECT	df	MS	F	p
BETWEEN SUBJECTS				
Gender	1	47.580	0.352	0.558
Error	30	135.362		
WITHIN SUBJECTS				
Time	1	277.620	6.525	0.016
TimexGender	1	5.433	0.128	0.723
Error	30	42.544		

DESCRIPTIVE RESULTS

	YEAR					
	1983			1996		
	Mean	SD	%ile	Mean	SD	%ile
Females	10.6	7.6	6.6	5.8	5.7	11.8
Males	11.7	12.8	9.5	8.1	9.0	15.4

Table 18 Comparison of Effect Sizes for Sit-ups

GROUP	Population ES	Sample ES
Male	-.56	-.53
Female	-.23	-.69

4.4 Flexibility

Flexibility was measured with the use of a forward trunk flexion sit and reach test (Government of Canada, 1981). An examination of the mean values for this test show that the participants performed better in 1996 than they did in 1983. In 1983, the males had a mean flexibility score of 22.9 cm. (percentile= 31.4) and a mean score of 23.3 cm. (percentile= 36.1) in 1996. The females had a mean score of 22.7 cm. (percentile= 19.4) in 1983 and a mean score of 26.2 cm. (percentile= 32.5) in 1996.

Two female participants scored very low in 1983 (4.2cm, 9cm) in comparison to the other participants. These two outlying scores had a large impact on the mean. When these two scores are excluded from the calculation of the sample, the mean then becomes 26.6 cm similar to the mean in 1996. Although the participants displayed an uncharacteristic in flexibility, the increase was found to be nonsignificant (p= 0.120).

Table 19 **Repeated Measures ANOVA for and Descriptive Results for Flexibility**

EFFECT	df	MS	F	p
BETWEEN SUBJECTS				
Gender	1	5.455	0.043	0.837
Error	30	127.392		
WITHIN SUBJECTS				
Time	1	113.036	2.555	0.120
TimexGender	1	80.213	1.813	0.188
Error	30	44.237		

DESCRIPTIVE RESULTS

	YEAR					
	1983			1996		
	Mean	SD	%ile	Mean	SD	%ile
Females	22.7	7.5	19.4	26.2	8.7	32.5
Males	22.9	9.5	31.5	23.3	10.0	36.1

Comparisons of the magnitude of change with the general population will not be undertaken as the changes in flexibility between the population and the sample are in opposite directions (increases vs. decreases).

4.5 Cardiovascular Endurance (predicted VO_{2max})

Table 20 contains the individual results for males and females for the Step Test. One male participant was unable to complete the step test in 1996 due to a weakness in one leg. Two female participants did not complete the step test in 1996. One refused to continue after commencing and another was not able to follow the stepping pattern after 30 minutes of instruction. Scores for VO_{2max} were available from 1983 for all participants.

All participants who completed the step test demonstrated the correct stepping pattern. However, most were unable to maintain the correct tempo corresponding to their level. This pattern is consistent with previous studies which reported problems with maintaining a stepping cadence especially at the faster cadences (Cressler, et al., 1988; Reid, et al., 1985; Seidl, 1986). Participants were able to increase their stepping rates from stages one to three, however the stepping rate (ie. 14 ascents/min) was generally inconsistent through each stage. For participants who were unable to maintain the predetermined tempo, actual rather than desired stepping rates during the final three minutes were used to calculate the oxygen requirements (litres/min). The oxygen requirements were interpolated from the values reported by Jette et al. (1976). It is important to note that when using actual rather than predicted energy values, Jette et al. (1976) reported a mean over prediction of 3.9% for the first four stages and a mean under - prediction of 4.2% for the last two stages for a female of 60 kilograms.

The mean percentiles in both 1983 (7.6) and 1983 (17.0) for males imply that their level of cardiovascular fitness is described as "Poor". This description also holds true holds true for females (1983= 16.0; 1996= 20.1). The individual data for 1983 show that nine

Table 20 <u>Cardiovascular Endurance Individual Results(Predicted VO2max)</u>

Subject	Age	Year	VO2	%ile	Subject	Age	Year	VO2	%ile
1M	24	1983	30.0	0	17M	24	1983	32	0
	37	1996	35.1	4.4		36	1996	-	-
2M	28	1983	29.0	0	18M	23	1983	40.0	5.8
	41	1996	32.7	8.9		36	1996	36.7	9.5
3M	41	1983	36	32.5	1F	21	1983	31.0	0
	54	1996	32	31.3		34	1996	-	-
4M	24	1983	36.0	2.2	2F	24	1983	31.7	10.0
	37	1996	28.8	0		37	1996	26.7	2.8
5M	38	1983	37.0	10.8	3F	32	1983	33.0	48.8
	51	1996	39.7	95.5		45	1996	33.6	89.0
6M	22	1983	36.0	2.2	4F	33	1983	27.8	4.2
	35	1996	38.5	17.5		45	1996	24.0	4.5
7M	22	1983	35.0	1.5	5F	32	1983	26	1.9
	35	1996	35.8	5.0		45	1996	24.4	5.0
8M	22	1983	38.0	3.7	6F	33	1983	30.0	14.5
	35	1996	37.8	13.8		46	1996	25.4	11.0
9M	26	1983	42.7	14.7	7F	34	1983	24.0	0
	38	1996	33.6	3.0		47	1996	20.2	0
10M	23	1983	40.1	6.2	8F	30	1983	26.0	1.9
	36	1996	35.5	4.7		45	1996	24.1	4.6
11M	34	1983	31.0	0.6	9F	38	1983	33.0	48.8
	47	1996	27.9	0.4		51	1996	32.2	96.0
12M	21	1983	43.0	16.0	10F	22	1983	34.0	27.5
	34	1996	35.1	4.4		35	1996	25.0	0.6
13M	22	1983	33.0	0	11F	24	1983	34.0	27.5
	35	1996	25.8	0		37	1996	24.2	0
14M	44	1983	32.0	5	12F	31	1983	28.9	8.6
	57	1996	31.3	24.2		43	1996	28.1	33.8
15M	26	1983	37.0	3.0	13F	23	1983	33.7	24.0
	39	1996	32.0	1.5		36	1996	27.1	3.3
16M	39	1983	37.0	10.8	14F	23	1983	27.0	0
	52	1996	35.1	66.3		36	1996	-	-

Average", two as "Minimum", and one as "Good". With respect to descriptive category, seven males increased and one decreased.

The individual data for females in 1983, reveals that four were described as having "Poor" cardiovascular fitness, three as "Below Minimum", and five as "Minimum". In 1996, five females are described as having "Poor" levels of cardiovascular fitness, four as "Below Minimum", one as "Minimum", one as "Good", and one as having "Excellent" performance on the step test. Of the 12 females who completed the step test in both 1983 and 1996, four decreased and six increased their ranking description according to their age group.

Table 21 outlines the results of the repeated measures ANOVA. A significant main effect of gender indicates that females had significantly lower level of cardiovascular fitness than males in both 1983 and 1996. In addition, subjects decreased in VO_{2max} significantly from 1983 to 1996.

Table 21 **Repeated Measures ANOVA and Descriptive Results for VO2max (predicted)**

ANOVA

EFFECT	df	MS	F	p
BETWEEN SUBJECTS				
Gender	1	642.840	28.415	0.000
Error	28	22.623		
WITHIN SUBJECTS				
TIME	1	119.501	11.432	0.002
TimexGender	1	0.053	0.005	0.944
Error	11	10.453		

Table 21 (continued)

DESCRIPTIVE RESULTS

	YEAR					
	1983			1996		
	Mean	SD	%ile	Mean	SD	%ile
Females	30.0	3.4	16.0	26.3	3.7	20.1
Males	36.2	4.3	7.6	33.7	3.8	17.0

Table 22 indicates that the males had a medium effect size in comparison to the large effect size seen in the population. The females were reported to have a much larger effect size (large) than the population (medium). Interestingly, the males had a medium effect size compared to the population's large effect size. This data indicates that females in this study have very large changes in cardiovascular endurance when compared to males and the expected population changes.

Table 22 Comparison of Effect Sizes for VO2max (predicted)

GROUP	Population ES	Sample ES
Male	-.87	-.60
Female	-.67	-1.02

Chapter 5

Discussion

The purpose of this study was to describe the physical fitness of persons with an intellectual disability and how their fitness has changed over time. This chapter will include discussion of the results outlined in Chapter four as they relate to the stated hypotheses and literature. Chapter five is organized in the following manner: (5.1) Anthropometric Measures; (5.2) Muscular Endurance; (5.3) Flexibility; (5.4) Cardiovascular Endurance; (5.5) Change in Physical Fitness-Hypothesis 3.3.1; (5.6) Magnitude of Change in Physical Fitness as Compared to the Population.

5.1 AnthropometricMeasures

5.1.1 Height

The height of both males and females in this study is described as "Below Average" when compared with adults of a similar age group. This finding is similar to one other study (Reid et al., 1985). The individual data indicate that for the majority of participants height decreased over time. This follows the trend in the data collected for the Canada Fitness Survey (Government of Canada, 1981), yet, small effect sizes were found for both males and females for change in height between 1983 and 1996.

Males typically show a height increase until 25-29 years and gradually decrease thereafter (Spirduso, 1995). Females usually begin losing height as early as 16 years of age. In general, females lose height more quickly than males due to a higher prevalence of osteoporosis, especially after menopause. However, in this study, females appear to have lost height at the same rate as males, as evidenced by similar effect sizes (see Table 5).

5.1.2 Weight

Participants had a significant increase in weight between 1983 and 1996. This is consistent with findings for persons without disabilities which report steady increases in weight until 50 years of age (Spirduso, 1995). After age 50, weight begins to level off and then decrease slightly during old age (Government of Canada, 1981). The levelling off and decrease in weight after age 50 is apparent in this study. An examination of the individual data show that in 1996, 4 of the 5 participants over age 50 had a decrease in weight from 1983.

In 1983, both males and females were described as having "Below Average" weight when compared to non-handicapped (Government of Canada, 1986). However, males and females increased their weight by 1996 to the extent where they were considered "Average". The data for weight must be interpreted with caution as "Below Average" or "Average" weight for persons who are shorter in stature may in fact be classified as "Overweight" in relation to height.

Weight increase can result from a number of factors such as an increase in muscle mass or increases in body adiposity. Again, in order to make meaningful interpretations, changes in weight must be looked at in conjunction with Body Mass Index (BMI) and Percent Body Fat.

5.1.3 Body Mass Index (BMI)

BMI is a way of expressing weight in relation to the height of the person (Government of Canada, 1996; Spirduso, 1995). BMI scores should be taken into consideration along with skinfolds measurements to account for distribution of body fat. As mentioned earlier, increase in BMI may be proportional to increase in muscle mass or body fat. Given the information which describes persons with an intellectual disability as having below average height, an examination of BMI gives a relative measure of the participant's weight in proportion to height.

BMI was described as "Average" compared to persons without disabilities for both males and females (Government of Canada, 1981). The females, however, moved to a less favourable description in 1996 (below average). The substantial increase in BMI for females is indicative of an increase in body fat and is consistent with findings that women increase in BMI for 25 years after mens' BMI has stabilized (Spirduso, 1995). This may be attributed to women having a substantial loss of muscle coupled with an increase in fat, compared to men who generally having only a loss of muscle mass (Spirduso, 1995).

Increase in body fat content may be linked to certain common chronic diseases (Rauramma et al., 1994). Effect sizes for both males and females show a greater magnitude of change in BMI than expected in the population and may indicate that persons with an intellectual disability are at a certain health risk for coronary heart disease and Type II diabetes (Shephard, 1990).

5.1.4 Percent Body Fat

Fox and Rotatori (1982) have shown that there exists a prevalence of obesity for persons with an intellectual disability. In this study, results from the three levels of analysis (individual, group, and comparative) for percent body fat confirm that potential health risks mentioned in the previous section may exist. The increase in weight and BMI from 1983 to 1996 are explained by an increase in percent body fat. Of all the variables measured, percent body fat appears to have resulted in the greatest magnitude of change for both males and females. Although some increase in body fat is typical of an aging population, the participants in this study displayed a substantially greater magnitude of change than the population, as evidenced by large effect sizes. Lifestyles which are sedentary may serve as a possible explanation for the high prevalence of obesity within this sample (Fox & Rotatori, 1982; Montgomery et al., 1987; Fernhall, 1990). This is disconcerting as this sample, especially the females, who had already high levels of body fat in 1983, appear to be accumulating fat at an alarming rate. The health risks associated with high levels of body fat (ie: cardiovascular disease, Type II diabetes) should be of major concern for this sample (Blair, 1995; Pitetti et al., 1993; Rauramma et al., 1994, Rimmer et al., 1994).

5.2 Muscular Endurance

The literature suggests that age related changes are more subtle and gradual for muscular endurance as compared to changes in other physical fitness performance variables (Government of Canada, 1981). Results in this study showed that changes in performance were markedly greater for situps than pushups. This is consistent with the findings of Reid et al. (1985). The test of situps measures the muscular endurance of the muscles around the trunk area while pushups measure the muscular endurance of the upper arm and shoulder muscles. Disuse can erode the strength and endurance of certain muscle groups (Spirduso, 1995). A greater decline in strength and endurance occurs in muscles used infrequently. Most of the participants work in assembly lines where they sit for the majority of the day. During the work day they have little opportunity to use the muscles in the trunk area. Perhaps the muscles of the trunk area for this sample have been used less frequently than the muscles in the upper body, explaining the differences in performance between sit-ups and push-ups.

The effect size (-.69) describing the change in muscular endurance for sit-ups, appears to indicate that the females are losing muscular endurance of a greater magnitude than males (ES=-.53) when compared with the population. However, females performed better in pushups in 1996 than in 1983. In fact, males had a small magnitude of change (-.28) compared to the moderate effect size for the population (-.40). It appears that age-related change in muscular endurance is dependent upon the modality of exercise used and muscle groups being tested. No known data have been found to explain differences in muscular endurance as it relates to aging for different muscle groups. A need for information in this area has been noted by Pitetti et al. (1993).

5.3 Flexibility

Flexibility is the degree to which an individual can move the joints through a range of motion (Canada Fitness Survey, 1981). Flexibility has been cited as difficult to measure because performance is partly dependent on how much pain one is willing to endure (Spirduso, 1995). This measure may be even more difficult for persons with an intellectual disability, as they have difficulty expressing discomfort when experiencing pain.

Compared to the 1983 performance, participants improved their performance on the sit and reach test of flexibility, yet the repeated measures ANOVA showed that the increase was not significant. In order to determine whether the results were due to experimenter error ten participants were retested producing an intra-class correlation of 0.92. Interestingly, the males, maintained the description of having "Below Average" flexibility in 1983 and 1996. Females, on the other hand, changed from a description of "Below Average" in 1983 to "Average" in 1996.

5.4 Cardiovascular Endurance

Cardiovascular Endurance is defined as the ability of the heart and lungs to deliver oxygen to the muscles which in turn use the oxygen to perform work (Government of Canada, 1986). The Canadian Home Fitness Test (CHFT) provides an estimation of VO_{2max} based on submaximal performance. The test is considered to be representative of cardiovascular fitness (Government of Canada, 1981).

The descriptive results from both 1983 and 1996 indicate that the individuals in this study have inferior cardiovascular fitness when compared with persons without a disability. Other studies support these findings (e.g., Reid et al., 1985, Pitetti & Tan, 1991; Rimmer et al., 1993). Cardiovascular efficiency is related to muscle mass (Shephard, 1987b). Males have more muscle mass than females and thus have the capacity to use the oxygen needed during aerobic endurance activities. In terms of aging, muscle mass also has a direct effect on cardiovascular performance. Females lose a higher percentage of muscle mass than males as they age (Spirduso, 1995) which may partially explain the lower performance of females than males on tests of cardiovascular endurance.

Regardless of the level of training, cross-sectional data demonstrates that VO_{2max} decreases with age (Government of Canada, 1982). Physical activity patterns in persons with an intellectual disability suggest that these persons are significantly less active than persons without disabilities (Hoge & Dattilo, 1995). A sedentary lifestyle results in a lower level of cardiovascular fitness. The significant change in VO_{2max} for both men and women with intellectual disabilities suggests that age related loss in performance may be partly due to a sedentary lifestyle. The participants showed low levels of cardiovascular endurance, especially the females. In addition, females had a very large magnitude of change in predicted VO_{2max} (ES=-1.02) as compared to the population (ES=-.67). Since a minimum VO2 of 13 $ml.kg^{-1}.min^{-1}$ is considered necessary for independent living (Shephard, 1987a), the sample of females appear to be in danger of succumbing to the health risks associated with low levels of cardiovascular fitness. Thus, if this decline in VO_{2max} continues, the females would be in danger of having disabling levels of fitness at an earlier age than expected, preventing them from living independently.

5.5 Change in Physical Fitness-Hypothesis 1.3.1

The results of the repeated measures ANOVAs indicate that there is a significant decrease in fitness for persons with an intellectual disability in all areas with the exception of flexibility, muscular strength and the muscular endurance test of push-ups. While there is a tendency for females to show a greater change in physical fitness than the males for most variables, these changes were not significant. Information on persons without disabilities also support these findings (Shephard, 1987a; Spirduso, 1995). With an already documented sedentary lifestyle, minimal knowledge about the debilitating effects of poor physical fitness and health and an inability to take command of their personal state of health (Pitetti et al, 1993), the persons in this study are falling even further into levels of fitness which may place them at risk for disease and a loss of independence. Percent body fat and cardiovascular fitness appear to be the two areas where the most dramatic changes are seen. Hypothesis 1.3.1; that the participants will have significantly lower levels of physical fitness in 1996 compared to 1983, can then be accepted for all components with the exception of flexibility and muscular strength.

Although these findings do not focus on the main interest of this study, it is nevertheless meaningful from the point of view that persons with an intellectual disability already have low levels of fitness and continue to decrease in fitness with age. If this decline in fitness continues, certain health risks associated with lower limits of physical capacity will be acquired at a younger age than expected in the general population. In other words, this population will reach old age prior to chronological age expectations.

5.6 Magnitude of Change in Physical Fitness-Hypothesis 1.3.2

Hypothesis 1.3.2 stated that the magnitude of change in fitness for adults with a disability will be greater than the magnitude of change in fitness expected in the general population. The empirical data have already established that persons with an intellectual disability have a lower level of physical fitness than persons without disabilities (Beasley, 1982; Coleman et al., 1976; Fernhall, 1993; Pitetti et al., 1989; Reid et al., 1985), and this current study has replicated this fact. Notwithstanding, the main interest in this study was to measure the change in physical fitness of persons with an intellectual disability in comparison to expectations of the general population. As mentioned earlier, Shephard (1987a) has suggested that lower limits of physical fitness can affect the capacity of persons with and without a disability to perform basic functions of independent living. The hypothesis sought to seek out information which suggests that persons with an intellectual disability already have a lower level of physical fitness than persons without disabilities and, more importantly, that their change in physical fitness is of a greater magnitude than the general population.

The results from the calculation of effect sizes indicate that the change in physical fitness for persons with an intellectual disability is of greater magnitude than expected in the general population for the following variables: maximum oxygen uptake, height, weight, BMI, percent body fat, and situps for females. Moreover, the data indicate that females appear to be vulnerable to these changes, especially for the variables of percent body fat and VO_{2max}.

Two anthropometric measures, BMI and percent body fat, showed significant differences of change between the sample and the population. For BMI the population had small effect sizes compared to the moderate effect sizes of the population. The sample had large effect sizes for percent body fat compared to the small effect sizes expected in the population. Both flexibility and grip strength were not compared to the population as increase in performance of these variables was contrary to the decrease observed in the population data. A significant increase in grip strength appears to be the result of instrumentation error and, therefore, was not analysed at the level of comparison with the population. Further investigation into changes in activity patterns and testing preparation for persons with an intellectual disability seems warranted.

Muscular endurance was measured with pushups and situps. The effect sizes indicated that a decline in performance in both population and sample groups was greater for situps than push-ups. There were no marked differences in push-ups for both males and females with an intellectual disability when compared to the population. However, there were large differences for women in the performance in situps between 1983 and 1996. The males effect sizes were very similar to the population (moderate). The results indicate that situps, measuring the endurance of the muscles of the trunk area, appear to have changed more notably than pushups, measuring the endurance of the muscles of the arms and shoulders, especially for females. Certain muscle groups deteriorate quicker than others due to disuse rather than aging (Spirduso, 1995). As well, some evidence suggests fat is distributed to a greater extent in the waist and hip area resulting in greater losses of muscle mass (Shephard, 1987b). Thus, it is possible that a sedentary lifestyle additionally contributed to the decline in muscular endurance normally related to aging.

Like percent body fat, the change in predicted VO_{2max} of females between 1983 and 1996 was large (ES= -1.02) compared to the moderate change expected for persons without disabilities (ES= -.67). These findings are very concerning, as cardiovascular fitness has been identified as having a direct relationship to one's ability to perform tasks of daily living and may be related to the prevention of disease (Jette et al., 1992). In contrast the males had a moderate effect size (-.60) than the large effect computer for the population (-.87).

It is important to highlight the results of the individual data to shed light on the enormous variability among the subjects. Although the general group trend for cardiovascular endurance (and with other variables) is a decline in performance, the individual data shows that certain individuals had little change or an improvement in performance between 1983 and 1996. This variability in performance has been previously discussed (Seidl et al., 1987) and has prompted some to advocate alternate methods of data analysis when dealing with special populations (Bouffard, 1992; Watkinson and Wasson, 1984). Although this research has shown a definite group trend toward a decline in fitness, the variability among the subjects must be scrutinized for contributing factors such as; fluctuations in motivation, differences in lifestyle, dietary habits, etc. affecting changes in fitness with aging.

Generalizations about the magnitude of change in overall fitness are difficult to explain in light of the varying degrees of change between the variables measured used in this study. To date no measure of total fitness is available within the CSTF (Government of Canada, 1986). A general conclusion can be made that the hypothesis (1.3.2) stating that a greater magnitude of change will occur in persons with an intellectual disability when compared to the population, is accepted for the component of Cardiovascular Endurance in females, Body Adiposity (weight, BMI, percent body fat) for both males and females, Muscular Endurance as measured by situps for females. Hypothesis 1.3.2 is rejected for the dependent measures of Flexibility, and Push-ups for both males and females, and Cardiovascular Endurance for males.

Chapter 6

Summary, Conclusions, and Recommendations

The purpose of this study was to describe the physical fitness of persons with an intellectual disability and how fitness changed over time. This chapter contains the summary and conclusions of this inquiry and recommendations for future research. Chapter 6 is organized in the following manner: (6.1) Summary of the Methodology; (6.2) Summary of the Findings; (6.3) Conclusions; (6.4) Implications; and (6.5) Recommendations for Further Inquiry.

6.1 Summary of the Methodology

Thirty-two adults with an intellectual disability participated. There were 18 males and 14 females. Males had a mean chronological age of 40.9 years and ranged in age from 35 - 57. Females had a mean chronological age of 41.5 years and ranged in age from 34 - 51. All were determined to be free from physical and medical disabilities with the use of a screening questionnaire. The participants were selected from a study in 1983. Their data from 1983 was obtained for the purposes of comparison to data collected in 1996. The participants were described as moderately to mildly intellectually disabled and all worked in supported employment at a readaptation center. Informed consent was obtained from the participants and their legal guardians and approval to conduct the research was given by the McGill University Ethics Committee.

Data were collected using the procedures of the Canadian Standardized Test of Fitness (Government of Canada, 1981, 1986). The dependant variables were anthropometric measurements of height, weight, BMI, and the sum of four skinfolds; cardiovascular fitness as measured by a step test; flexibility as measured by a sit and reach test; muscular endurance and strength as measured by tests of sit-ups, push-ups, and hand grip strength.

Procedures from the CSTF (1981) were used with all variables except the step test which followed the modified procedures outlined in Reid et al. (1985). In this test some subjects were unable to maintain the recommended tempo, thus, actual, rather than recommended stepping rates, were used to calculate the oxygen cost of stepping.

During a visit to their homes, participants were familiarized with the testing instruments and procedures prior to the testing sessions. During the testing sessions verbal encouragement and praise were given for all attempts made. In addition, some physical prompting was given for participants that were initially unable to properly perform the tasks. Most participants, with the exception of two, were able to complete all of the testing items. Two female subjects did not complete the step test. One was unable to learn the correct stepping cadence and the other stopped stepping after one completed stage. In addition, one of these females was unable to learn the correct technique for the push-ups.

The data from 1983 and 1996 were used to compare changes in physical fitness over time. In order to test hypotheses, a three level approach was used to analyse the data. First, individual data were analyzed to describe the performance of individuals and groups based on descriptive norms from the CSTF (Government of Canada, 1981, 1996). Second, simple repeated measures analyses were performed on each dependant measure to illustrate the change in physical fitness from 1983 to 1996. Third, in order to determine the magnitude of change in fitness over time as compared to the population, effect sizes for both the population and the sample was calculated and compared. Due to small sample sizes, the effect sizes were corrected using the methods of Hedges (1981).

6.2 Summary of the Findings

Results from this study confirmed previous research which demonstrated that persons with an intellectual disability have lower levels of fitness when compared with norms established for persons without disabilities. Generally, females had lower scores on most fitness measures than males. A repeated measures analysis of variance on each dependant measure demonstrated significant differences for the variables of cardiovascular fitness, weight, BMI, percent body fat, and muscular endurance. In addition individual analysis indicated that there was high variability in performance among the participants. While some showed a decrease in performance between 1983 and 1996, others showed little change or improvement.

Effect sizes were used to determine the magnitude of change between fitness measured in 1983 and 1996. These effect sizes were compared to the calculated effect sizes for the population as represented by data taken the Canada Fitness Survey (1981). Larger effect sizes (<.70) were found for females than the population in muscular endurance as measured by sit-ups and cardiovascular fitness. Both males and females had greater changes in body composition (weight, BMI, and percent body fat). Persons with an intellectual disability had a greater change of physical fitness with age, as previously mentioned there was high subject variability in performance within and between each component of fitness. It is also important to note that 25% of the potential sample was screened out of the testing due to some form of an acquired disability. This percentage is rather high and may indicate a tendency of this population to acquire functional losses of a greater frequency that the general population.

6.3 Conclusions

Based on the findings of this study and within the limitations previously outlined, the following conclusions may be made:

1. Adults with an intellectual disability have below average scores on most components of physical fitness when compared to Canadian adults without a disability of comparable age and gender.

2. Females with an intellectual disability have poorer levels of physical fitness than males with an intellectual disability.

3. Adults with an intellectual disability have significant changes in physical fitness as they age.

4. Adults with an intellectual disability generally have a greater magnitude of change in physical fitness as they age when compared to Canadian adults without a disability of comparable gender and age.

6.4 Implications

It has been previously demonstrated that adults with an intellectual disability exhibit substandard physical fitness when compared to adults without disabilities. The findings of this study reinforce these previous data. It has also been shown that in the population of non-disabled adults, poor levels of fitness may increase the risk of some common chronic diseases such as diabetes mellitus, and cardiovascular disease. In terms of physical fitness characteristics, evidence exists indicating that persons with an intellectual disability have an earlier onset of old age presumably due to sedentary living habits which result in low levels of physical fitness (Pitetti and Campbell, 1991). There also appears to be a tendency in this population to acquire an early onset of cardiovascular disease. No data exists explaining the causes of early onset conditions which affect health. Further to this, no known data exist which trace the effects of aging of physical fitness and health for persons with an intellectual disability.

The major contribution of the study is it has demonstrated that, when compared to the general population, the magnitude of change in physical fitness is generally larger for adults with an intellectual disability. The tendency is to fall deeper into already lower levels of physical fitness as aging occurs. Although these findings are preliminary in nature and subject to certain limitations, it does imply that the physical fitness of persons with an intellectual disability declines at a faster rate than persons without a disability. More importantly, the results indicate that the percentage of body fat and cardiovascular fitness of the participants were shown to have the greatest magnitude of change when compared to other components of fitness, especially for females. Poor cardiovascular fitness and excess body fat are seen as major indicators for cardiovascular diseases.

The findings support the small amount of research illustrating an early onset cardiovascular disease and old age in persons with an intellectual disability. In light of these findings, health professionals and care-givers should recognize the specific and urgent physical fitness needs for these people. Appropriate measures need to be taken to find ways of increasing the physical activity patterns of a characteristically sedentary population. The findings of this study also have implications for additional interactive factors influencing the health of persons with an intellectual disability. Poor levels of fitness may lead to poor health, potentially placing a public burden on the health care of these people. Escalating health care costs and societal responsibility for an increasing population of adults with an intellectual disability are areas of concern. Additionally, diet and nutritional habits must be examined for any interactive effects on fitness and health.

Given the findings of this investigation, the duration, intensity and frequency of participation in physical activity is of interest for those investigating dose-response issues. With some evidence suggesting that moderate amounts of physical activity can improve health, the implications for persons with an intellectual disability are encouraging. Perhaps, the Active Living movement may be a feasible means of encouraging people to provide accessible programs which will encompass the physical, nutritional, and social needs of this population.

6.5 Recommendations for Further Investigation

1. Research which describes physical fitness has lacked the comprehensiveness of measurement of Reid et al. (1985). In order to explain the relationship between specific components of fitness and their influence on functional capacity and health, more descriptive research is needed which looks at all components of physical fitness.

2. Information about the effects of aging and physical activity on the physical fitness of persons with an intellectual disability is lacking. Longitudinal studies with inclusion of lifestyle questionnaires are needed to determine the relationship between aging and effects on physical activity, fitness, and health.

3. Research is needed to determine the causes and interactions of factors which contribute to low levels of fitness. Is a sedentary lifestyle the cause of low fitness or low fitness the cause of a sedentary lifestyle?

4. Considering the low levels of physical fitness, it appears that persons with an intellectual disability are at a higher risk for disease than those without disabilities. More research is needed to determine a clear relationship between the early onset of disease and/or disabling conditions and poor physical fitness.

5. Further investigation into developing valid and reliable measures of physical activity for persons with an intellectual disability is needed. Moreover, in order to obtain accurate measures of physical fitness, researchers must develop standardized protocols and techniques which take into consideration the problems of motivation and variable performance of persons with an intellectual disability.

6. The variability in performance in persons with an intellectual disability is apparent. Future research should employ the use of individual analysis along with traditional group analyses to provide detailed information about the variability in performance often seen in this population.

7. Since, until now, no research has been available describing the changes in physical fitness of persons with an intellectual disability as they age, replications should be conducted to discover the generalizability of the findings obtained in this study.

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APPENDIX A

ANTHROPOMETRIC PROCEDURES

HEIGHT

(Equipment and procedures)

Equipment:

Metric Wall tape, set square

Procedure:

Position the tape vertically against a wall. Ensure that the tape is perfectly straight and even with the floor.
The participant will be without footwear. The participant's back is placed against the wall tape with the heels together and the body stretched upward to its fullest extent, the shoulders relaxed and the arms placed at the side.
The set square is rested on top of the head, making contact with the skull and against the tape.
Height will be recorded to the nearest 0.5 cm from the highest point on top of the head.

Note: From the Canadian Standardized test of Fitness Operations Manual, 2nd. ed., p.7, by Fitness and Amateur Sport Canada, 1981, Ottawa, Ontario, Canada: Author: Copyright 1981 by Minister of Supplies and Services.

WEIGHT

(Equipment and procedures)

Equipment:

Spring or beam scale

Procedure:

The participant will be without footwear and in light clothing (shorts and t-shirt or blouse for women). Ensure the scale is placed on a flat surface. Weight will be recorded to the nearest 0.05kg.

Note: From the Canadian Standardized test of Fitness Operations Manual, 2nd. ed., p.7, by Fitness and Amateur Sport Canada, 1981, Ottawa, Ontario, Canada: Author: Copyright 1981 by Minister of Supplies and Services.

SKINFOLDS
(Equipment and procedures)

Equipment:

Harpenden Caliper

General Procedures:

The four skinfolds will be measured twice and recorded to the nearest 0.2 mm. If the measurement differs by greater than 1.0 mm, a third measurement will be taken and the mean of the closest pair recorded.

Select the prescribed site. Grasp the skinfolds between the thumb and index finger 1 cm. above the site and apply pressure. The skin fold is raised and maintained with the thumb and forefinger with the crest of the fold following the specific alignment. Apply the caliper jaws at right angles to the prescribed site. Release the spring handles fully. Read the measurements after the full pressure of the caliper jaws has been applied, and the drift of the needle has ceased.

The four skinfolds are measured on unclothed sites on the right side of the body.

<u>Note that the accuracy of the measurement depends on the following:</u>

- <u>precise identification of the site of the skinfolds.</u>
- <u>forming the skinfolds prior to the application of the caliper jaws.</u>
- <u>the standardization of the alignment of the skinfolds crest.</u>
- <u>complete release of the spring handles of the caliper.</u>

Triceps skinfolds:

The participant stands with the arms relaxed at the sides. The skinfolds is measured on the unclothed right arm at a level midway between the tip of the acromium (top of shoulder) and the tip of the elbow.

With the participant's forearm flexed at a 90° angle, establish the midpoint. This can be approximated with the thumbs by placing the fifth finger of the left hand on the participant's right shoulder and the fifth finger of the right hand on the tip of the participant's elbow. Lift the skinfolds parallel to the long axis of the arm. Ask the participant to lower the forearm and then apply the caliper jaws to the site.

Biceps skinfolds:

Measured on the front right upper arm over the biceps at a level midway between the acromium and the tip of the elbow as described for the triceps. The skinfolds is lifted parallel to the long axis of the upper arm.

Subscapular skinfolds:

The participant stands with arms relaxed at the sides. The subscapular skinfolds is measured about 1 cm below the lower right angle of the right scapula. The crease of the skinfolds that is lifted should run at an angle of about 45° downwards from the spine.

Supra-iliac skinfolds:

The participant stands with the right arm slightly bent and at the side so that there is access to the skinfolds sight. Measured 3 cm above the iliac crest at the midline of the body, with the fold running parallel to the iliac crest.

Note: From the <u>Canadian Standardized test of Fitness Operations Manual</u>, <u>2nd. ed.</u>, p.10-11, by Fitness and Amateur Sport Canada, 1981, Ottawa, Ontario, Canada: Author: Copyright 1981 by Minister of Supplies and Services.

APPENDIX B

STRENGTH PROCEDURES

HAND GRIP STRENGTH
(EQUIPMENT AND PROCEDURES)

Equipment: Stoelting hang grip dynamometer.

Procedure:
Have the participant take the dynamometer in the appropriate hand, holding it down by the thigh. The grip is taken between the fingers and the palm at the base of the thumb. With a firm grip, hold the instrument away from the body and squeeze vigorously, exerting maximum force. Neither the hand nor the dynamometer are allowed to touch the body. both hands are measured alternately giving two trials per hand. The best score for each hand will be added and recorded as a single score to the nearest kilogram.

Note: From the Canadian Standardized test of Fitness Operations Manual, 2nd. ed., p.16, by Fitness and Amateur Sport Canada, 1981, Ottawa, Ontario, Canada: Author: Copyright 1981 by Minister of Supplies and Services.

APPENDIX C

MUSCULAR ENDURANCE PROCEDURES

PUSH-UPS
(Equipment and procedures)

Equipment:

Gym mat

Procedure:

Two levels of push-ups will be accepted with the participants.

Level 1:

The participant starts in the prone position (lying on stomach) with legs together and the hands pointing forward and positioned under the shoulders. Using the toes as a pivotal point, the participant will push from the mat, straighten the elbows and reach the up position. The upper body must be kept in a straight line as the participant returns to the starting position touching the chin to the mat. The push ups will be performs consecutively without a time limit. The test will be discontinued immediately upon seeing the participant show signs of strain. The number of successful push-ups completed will be recorded as the test of upper body muscular endurance.

Level 2:

The participant starts in the prone position with legs together. The hands are pointed forward placed directly under the shoulders. The participant pushes up from the mat with the hands, straightening the elbows and using the knees as a pivotal point. The upper body will be kept in a straight line as the participant returns to the starting position with the chin touching the mat. Push-ups will be performed consecutively and the test discontinued as soon as the participant begins to show strain. The number of successful push-ups completed will be recorded as the test of upper body muscular endurance.

SIT-UPS
(Equipment and Procedures)

Equipment:

Gym Mat, timer or stop-watch.

Procedure:

The participant will begin in the supine position (lying on the back) with the knees bent approximately 90 degrees and the feet about 30 cm apart. The hands will be placed at the side of the head, fingers touching the ears. The tester will hold the ankles of the participant ensuring the heels are in constant contact with the mat. When the participant is ready give the command "Begin". The participant is required to sit up and touch the knees with he elbows and return to the starting position. The tester will ensure that the participant's back returns to the original position and that the participant attempts to exhale when sitting up and inhale when returning to the starting position. The participant may pause whenever necessary. The participant will perform as many sit ups as possible in one minute.

Note: From the Canadian Standardized test of Fitness Operations Manual, 2nd. ed., p.17, by Fitness and Amateur Sport Canada, 1981, Ottawa, Ontario, Canada: Author:

APPENDIX D

FLEXIBILITY PROCEDURES

SIT AND REACH TEST
(Equipment and Procedures)

Equipment:

Modified Wells and Dillon sit and reach apparatus.

Procedure:

Before taking actual measurements, have the participant warm-up by performing slow stretching movements . The barefoot participant sits with legs fully extended with the soles of the feet placed flat against the horizontal crossbar of the apparatus and the inner edge of the sole placed 2 cm from the scale. Keeping the knees fully extended and the arms evenly stretched, palms down, the participant bends and reaches forward without jerking) pushing the sliding marker forward along the scale as far as possible. The position of maximum flexion must be held for approximately two seconds. At maximum flexion, encourage the participant to lower the head to obtain maximum reach. The knees must remain straight in order for the trial to be counted. Two trials will be permitted. Jerking movements will not be permitted. The maximum distance of the two trials will be recorded to the nearest 0.50 cm.

Note: From the Canadian Standardized test of Fitness Operations Manual, 2nd. ed., p.17, by Fitness and Amateur Sport Canada, 1981, Ottawa, Ontario, Canada: Author:

APPENDIX E

HEART RATE AND BLOOD PRESSURE PROCEDURES

(Equipment and procedures)

Equipment:

"SUNBEAM" Digital Blood Pressure and Heart Rate Monitor (Model 7650)

Procedure:

Have the participant rest for five minutes. Use a chair with comfortable arm rests. During this time the Canada Home Fitness Test will be explained and demonstrated. Apply the blood pressure cuff to the participant's left arm. The cuff should be wrapped firmly and smoothly 2-3 cm above the antecubital space. The arm should be comfortable with the lower edge of the cuff at heart level and at an angle of 0-45 degrees from the trunk. Press the "start" switch and the cuff will automatically inflate. When the pressure in the cuff has reached the pressure valve setting, the automatic exhaust mechanism will gradually reduce arm cuff pressure. NOTE: Accurate measurement cannot be taken when exhaust speed is outside the 2-5 mmHg range. when a pulse is detected, a beeping sound will begin indicating the heart rate is being taken along with the blood pressure reading. When the buzzer sounds this indicates that the measurements have been completed. Systolic pressure is displayed on the right, and diastolic is displayed on the left, 2 or 3 seconds later the pulse appears alternately on the display. If the resting heart rate is above 100 beats/minute, or the resting systolic blood pressure exceeds 150 mm Hg, or the resting diastolic blood pressure is over 100 mm Hg, wait an additional five minutes and take the readings again using the same procedure as above. The participant is excluded from the cardio-respiratory fitness test if the values are still above the criteria.

APPENDIX F

CARDIOVASCULAR ENDURANCE PROCEDURES

CANADA HOME FITNESS TEST (CHFT)
(Equipment and procedures)

Equipment:

Double 20.3 cm portable steps, tape player, CHFT tapes, timer.

Procedure:

The participant steps up and down the two steps in synchronization with a tempo delivered on a music tape. The stepping cadence for one ascent and descent of the box is described to the participant with the help of the following description from the prepared tape:

STEP - STEP - UP
STEP - STEP - DOWN
UP - 2 - 3
DOWN - 2 - 3
UP - 2 - 3
DOWN - 2 - 3

The participant practices the starting sequence, first without the music and then with the music. Ensuring the participant places both feet completely on the second step and that the legs are completely extended and back upright at the top of the steps.

The starting stepping exercise is based on the age of the participant and can be found below .

SEX	AGE	STARTING EXERCISE			SECOND STAGE		
		LEVEL	CADENCE	ASCEND /MIN	LEVEL	CADENCE	ASCEN D/MIN
FEMALE	30-39	3	102	17	4	114	19
FEMALE	40-49	2	84	14	3	102	17
MALE	30-39	4	114	19	5	132	22
MALE	40-49	3	102	17	4	114	19

The stepping tempo will increase with each successive stage.

Each stage of the stepping exercise is three minutes in duration. When the three minutes are up, the participant is instructed to remain motionless. A 10 second post-exercise heart rate is recorded using the stethoscope. It is unnecessary to stop the tape between stages of the test since pauses for counting are recorded on the tape. The participant advances to the second and then third stage of the test if the heart rate is below a pre-established target value. The 10 second ceiling heart rates are:

AGE	AFTER 1st STAGE	AFTER 2nd STAGE
30-39	28	25
40-49	26	24
50-59	25	23

The heart rate from the last stage completed in the test is used to predict maximum oxygen uptake. The regression equation (Jette et al, 1976) used to predict maximum oxygen uptake is:

$$VO_{2max} = 42.5$$

$$+ 16.6\ VO_2\ (l/min)$$

$$- 0.12\ \text{Weight (kg)}$$

$$- 0.12\ \text{Post Exercise Heart Rate (beats/min)}$$

$$- 0.24\ \text{Age (yrs)}$$

Previous research (Reid & Montgomery, 1983; Seidl, 1986) have shown that some persons with an intellectual disability experience difficulty maintaining the tempos on tape. Therefore, counting the number of ascents for each participant and calculating the energy demand of the stepping using the values reported by Jette et al (1976) will be used as a means of obtaining a prediction of maximum oxygen uptake.

NOTE: The test will be discontinued if the participant begins to stagger, complains of dizziness, extreme leg pain, nausea, chest pain, or shows facial pallor. If any of these symptoms occur have the participant lie down, check the heart rate and blood pressure. Request assistance from
emergency medical personnel (ie. 911) if the participant does not seem to recuperate after a few minutes.

APPENDIX G
DATA COLLECTION FORMS

MCGILL UNIVERSITY - DEPARTMENT OF PHYSICAL EDUCATION
DATA SHEET

Name______________ Date_______ Tester______Date of Birth________

Age________ Gender___

Weight (lb.)_______ (kg 0.1)________ Refused **Height** (in.)_________

(cm 0.1)________ Refused

SKINFOLDS (nearest 0.2)

	Trial 1	Trial 2	Trial 3	Mean	Refuse	Unable
Triceps						
Biceps						
Subscapular						
Supra-iliac						
Total Skinfolds						

HAND GRIP STRENGTH (nearest 0.5 kg)

	Trial 1	Trial 2	Trial 3	Mean	Refuse	Unable
Right						
Left						
Total Strength						

BLOOD PRESSURE AND RESTING HEART RATE (sitting for 5 min.)

	Trial 1	*** Trial 2	Refused	Unable
Systolic				
Diastolic				
Resting HR				

*** Only do Trial 2 if participant exceeds the criteria for acceptance.

CANADA HOME FITNESS TEST (step test)

Name___________ Age_____ Refused____

	STARTING LEVEL					CEILING POST EXERCISE HR		
	MEN		WOMEN					
Age	Level	Steps	Level	Steps		Age	After Stage 1	After Stage 2
50's	2(84)	14	1(66)	11		50's	25	23
40's	3(102)	17	2(84)	14		40's	26	24
30's	4(114)	19	3(102)	17		30's	28	25
20's	5(132)	22	3(102)	17		20's	29	27
15-19	5(132)	22	4(114)	19		15-19	30	27
	6(144)	24	5(132)	22				
	7(156)	26	6(144)	24				

Starting Level	**Recommended Rate**	**Time**	**Actual Rate**	**Mean**	**H.R.**	**Comments**
	___ ___ ___ Total	1 2 3	_____ _____ _____	__	__	
	___ ___ ___ Total__	1 2 3	_____ _____ _____	__	__	
	___ ___ ___ Total__	1 2 3	_____ _____ _____	__	__	

If exercise was interrupted or discontinued, specify reason:________________

3 minute Recovery Heart Rate (in 15 seconds)___(beats/min)

Refused___ Unable to obtain___

PUSHUPS (number) Level 1____ Refused___

Level 2____ Unable to obtain___

(reason)___________

TRUNK FLEXION (nearest 0.5 cm)___ ___

Refused____ Unable to obtain___________

(reason)______________

SIT-UPS (max in 60 sec)

Level 1 (hands behind head)	No.___	Refused___
Level 2 (arms above head)	No.___	Unable to obtain___
Level 3 (holding assistant's hands)	No.___	(reason)

APPENDIX H

DESCRIPTION OF STUDY AND CONSENT FORM

Dear Parent/Guardian or Caregiver,

I am doing a Master's Thesis with the Department of Physical Education of McGill University under the supervision of Dr. Greg Reid. I would like to ask for your assistance and cooperation in completing my research.

The purpose of this research is to examine the change in physical fitness of a group of adults with an intellectual disability who were tested 13 years ago. _______ was part of this group tested by Dr. Greg Reid and his colleagues. By testing these individuals 13 years later, we hope to discover how their change in fitness compares to persons who are non-disabled.

The participation of the subjects will require them to be evaluated on "The Canadian Standardized Test of Fitness". Testing time will be a maximum of 2 hours and will take place at Options of the West Island Readaptation Center.

Six fitness tests will be used to evaluate each individuals' overall fitness; (1) measurements of standing height and weight; (2) body fat estimates from skinfolds measurements; (3) strength measurement using a hand grip device; (4) muscular endurance measurements using sit ups and push ups; (5) flexibility using a sit and reach test and; (6) cardiovascular endurance measurement using a step test. The procedures from the "Canadian Standardized Test of Fitness will be used for all tests with the exception of the step test.

The step test requires the person to ascend and descend two steps at a pre-established tempo set by a music tape. However, many participants in the study conducted 13 years ago experienced difficulty keeping a steady pace with the music, therefore, the participants in the current study will be asked to step at their own desired pace.

The fitness tests used in this study are used by thousands of children and adults every year in Canada. *I would like to assure you that the fitness tests are not extremely strenuous and that the safety and well-being of the participants will be given priority over their performance. The testers will be trained in the safety of administering the testing items. As well, safety controls are built into each test.* It is very important to note that adults with cardiovascular disease or chronic physical problems (ie, back, knee, etc) should not participate in this study. The participant may choose not to participate and may withdraw from the testing at anytime. Each participant will be screened for any medical problems by completing a Physical Activity Readiness Questionnaire (Par-Q).

Written permission and a completed Par-Q questionnaire are needed to enable _______ to participate in this study. Please fill out and sign the permission form attached indicating whether _______ will or will not participate by April 1, 1996. If you have any questions or concerns please call me at 684-9845 or Dr. Reid at 398-4185.

Thank you for your cooperation,

Andrew Graham (B.Ed. Phys.Ed.)

CONSENT FORM

check off one, sign the form, and return ASAP.

I have read and understood the information for Andrew Graham's study on physical

fitness. I **give permission** __ or I will **not give permission** __ for
__________ to participate in the study.
(name of participant)

PARENT/GUARDIAN/CAREGIVER SIGNATURE: ______________

PARTICIPANT SIGNATURE: (if possible): ______________

DATE: __________

APPENDIX I

REVISED PHYSICAL ACTIVITY READINESS QUESTIONNAIRE

(revised 1994)

PAR - Q & YOU

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

YES	NO		
☐	☐	1.	Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?
☐	☐	2.	Do you feel pain in your chest when you do physical activity?
☐	☐	3.	In the past month, have you had chest pain when you were not doing physical activity?
☐	☐	4.	Do you lose your balance because of dizziness or do you ever lose consciousness?
☐	☐	5.	Do you have a bone or joint problem that could be made worse by a change in your physical activity?
☐	☐	6.	Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?
☐	☐	7.	Do you know of any other reason why you should not do physical activity?

If you answered

YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want—as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

NO to all questions

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active—begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal—this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively.

DELAY BECOMING MUCH MORE ACTIVE:

- If you are not feeling well because of a temporary illness such as a cold or a fever—wait until you feel better; or
- If you are or may be pregnant—talk to your doctor before you start becoming more active.

Please note: If your health changes so [illegible] YES to any of the above questions, [illegible] Ask whether you should change [illegible]

Informed Use of the PAR-Q: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.

You are encouraged to copy the PAR-Q but only if you use the entire form

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction.

NAME ______________________

SIGNATURE ______________________ DATE ______________________

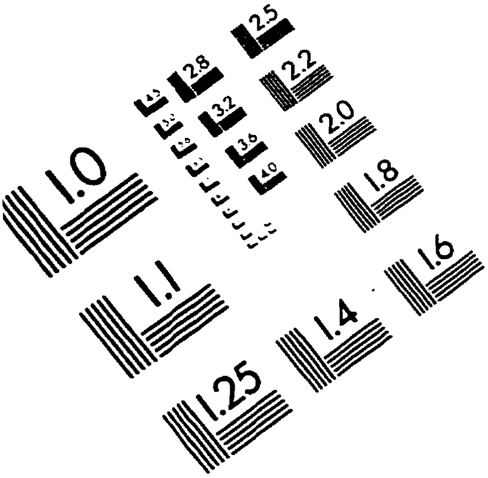
SIGNATURE OF PARENT ______________________ WITNESS ______________________
or GUARDIAN (for participants under the age of majority)

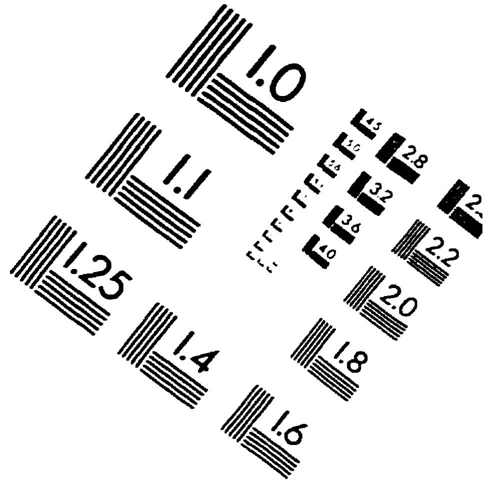
Supported by: Health Canada Santé Canada

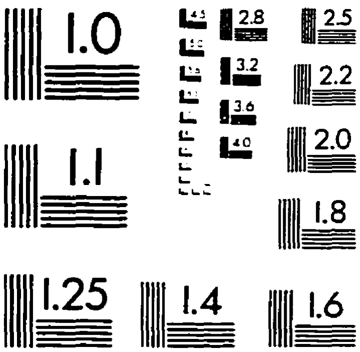
APPENDIX J

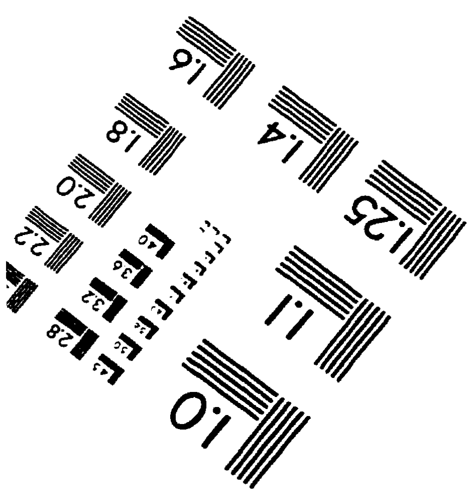
MCGILL ETHICS COMMITTEE APPROVAL

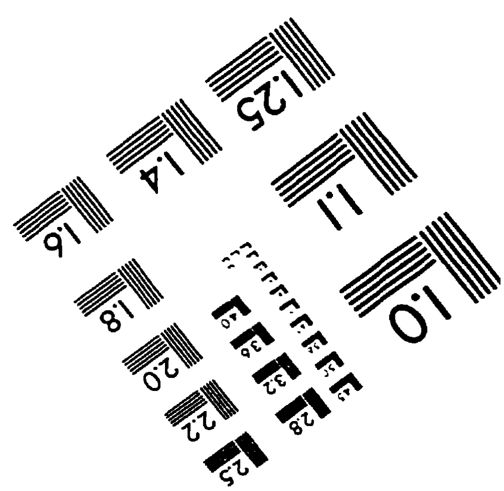
IMAGE EVALUATION TEST TARGET (QA-3)











150mm

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