Physical Fitness of Adults With an Intellectual Disability: A 13-Year Follow-up Study

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The purpose of this study was to describe the change in physical fitness of middle-aged adults with an intellectual disability over a period of 13 years. Participants were 32 adults who worked in a supported work environment in Montreal and had been participants in a physical fitness study in 1983. Using the Canadian Standardized Test of Fitness, the participants were evaluated for cardiovascular endurance, muscular strength, muscular endurance, flexibility, and body composition. A home visit prior to the testing session familiarized the participants with the test procedures. Two forms of analysis were used to describe the change in fitness over 13 years. First, a 2 x 2 (Group x Time) analysis of variance for each dependent variable assessed change over time. Second, effect sizes were calculated to measure the magnitude of change in fitness over the 13-year period in comparison to those without an intellectual disability. As expected, the physical fitness levels of the participants were low when compared to those without a disability and declined over the 13 years. In addition, the magnitude of change over the 13 years, as compared to those without a disability, was greater for male and female participants for body mass index and percentage of body fat and for female participants for cardiovascular endurance and sit-ups. It appears that adults with an intellectual disability may be particularly at risk for declining health associated with aging and low physical fitness.

Keywords: mental retardation, aging, physical activity, cardiovascular health

Research has demonstrated a significant decline in fitness throughout middle age (ages 30-60 years; Going, Williams, Lohman, & Hewitt, 1994; Lee, Paffenbarger, & Hsieh, 1992; Paffenbarger et al., 1994). This decline is related to a decrease in physical activity during this same period. Large epidemiological studies have shown that people need an adequate level of fitness to live healthy, disease-free lives (Blair et al., 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 coronary heart disease, osteoporosis, depression, hypertension, renal disease, Type II diabetes, and some forms of cancer (Rauramme, Tuomainen, Vaisanen, & Rankinen, 1995; Shephard, 1995). Estimates suggest that if half the population of sedentary individuals in the United States became moderately active, the number of deaths from coronary heart disease, colon cancer, and diabetes would fall by 22,000 per year (Blair, 1995). Specifically during middle age, there is an inverse relationship with heart disease and physical activity (Sandvik et al., 1995; Seccareccia & Menotti, 1992). Thus, physical activity and physical fitness have become important and meaningful areas of inquiry, particularly during middle age.

Perhaps the most extensive and comprehensive study of physical fitness and physical activity patterns was undertaken in Canada (Government of Canada, 1982). The Canada Fitness Survey assessed approximately 16,000 Canadians, ranging in age from 7 to 69 years, on fitness measures of body composition, cardiovascular endurance, muscular endurance, strength, and flexibility. It produced a cross-sectional view of the decline in fitness over the middle-age years. In addition, an extensive questionnaire explored issues such as preferred physical activities, extent of involvement, and barriers to present and future activity.
Most people have the ability and opportunity to attend to their own physical activity needs. However, others may require assistance to live a healthy and active lifestyle. This includes individuals with an intellectual disability, previously referred to as mental retardation. It is questionable whether they are aware of the debilitating consequences of a sedentary lifestyle or have enough self-direction to modify their lifestyle (Pitetti, Rimmer, & Fernhall 1999), particularly when one considers how difficult it is for people without a disability to initiate and adhere to an exercise program (Dishman, 1994).

It is well known that people with an intellectual disability exhibit poor fitness performance on standard fitness tests. This has been demonstrated with adults on measures of cardiovascular endurance (Beasley, 1982; Fernhall et al., 1996; Pitetti & Campbell, 1991; Reid, Montgomery, & Seidl, 1985), body composition (Fox & Rotatori, 1982; Reid et al., 1983; Rimmer, Braddock, & Fujiura, 1993), muscular strength and endurance (Horvat, Pitetti, & Croce, 1997; Pitetti, Climstein, Mays, & Barrett, 1992; Reid et al., 1985); and flexibility (Reid et al., 1985). Reid and Montgomery (1999) attributed the low levels on fitness tests to five potential factors: (a) a sedentary lifestyle (Hoge & Dattilo, 1995) and fewer opportunities for participation in structured programs; (b) physical characteristics such as short stature (Dobins, Garron, & Rarick, 1981; Reid, et al., 1985); (c) lack of coordination and efficiency (Seidl, Montgomery, & Reid, 1989); (d) infrequent opportunities to practice test items; and, (e) lack of motivation during testing and a tendency to stop when uncomfortable (Reid et al., 1985; Rimmer, 1994).

People with intellectual disabilities face many challenges in community living (Pedlar, 1990) as they continue to be included in all phases in society. Many facets such as work, maintaining a household, cooking, self-care, and recreation require the individual to possess a certain degree of physical stamina. People with an intellectual disability will need an adequate amount of fitness to contribute to work-related tasks and enjoy and benefit from participation in recreational activities (Fernhall, Tymeson, & Webster, 1988).

The decline in fitness during middle age, although well established for the nondisabled population (Spiriduso, 1995), has received little attention with regard to people who have an intellectual disability. It is likely that health risks associated with substandard levels of fitness would become exacerbated with these individuals, given their low levels of fitness, greater propensity for obesity, and sedentary lifestyle. In fact, Pitetti and Campbell (1991) pointed out that people with an intellectual disability have an earlier onset of physical old age and a higher mortality rate than the general population. They postulated that people with an intellectual disability have a faster rate of decline in physical fitness than the general population, although no empirical support was offered. Given the need for physical fitness as a factor in community and work participation, and the link between fitness and health, the investigation of the expected decline in physical fitness during middle age seems warranted. Reid et al. (1985) published a descriptive study of the fitness of 184 adults with an intellectual disability. The data had been collected in 1983 and were based on the test items from the Canada Fitness Survey. A group of these participants were available in 1996. Thus, the purpose of the present study was to describe the change in physical fitness that occurs in middle age with a sample of individuals who have an intellectual disability and to compare this change to established standards of the non-disabled population. It was hypothesized that the fitness of individuals with an intellectual disability would be lower in 1996 compared to 1983. It was also hypothesized that the magnitude of change in fitness for the adults with an intellectual disability would be greater than the magnitude of change expected in the non-disabled population.

Method

Participants

Participants were selected from a supported work environment that employed adults with an intellectual disability who had been involved in our previous study (Reid et al., 1985). The first author, who had worked for 6 years in the supported work environment, knew 56 participants from the 1983 study. We believed that personal knowledge of one of the experimenters would enhance the individuals' agreement to participate, and ease and validity of data collection. Therefore, the 56 adults received a description of the present study with informed consent documents via regular mail. Forty-eight people indicated a desire to participate, but 12 were eliminated due to some type of physical disability (see Table 1). These 12 individuals had been healthy participants in 1983, but due to an acquired or degenerative disability were unable to participate in 1996 when the present data were collected. Two participants subsequently refused to continue to be involved.

Thirty-four participants successfully completed the Physical Activity Readiness Questionnaire (PAR-Q; Thomas, Reading, & Shepard, 1992), but 2 did not complete the series of fitness tests, apparently due to lack of motivation. The final 32 participants, 14 women and 18 men, ranged in age from 34 to 57 years (M age = 41.2 years, SD = 9.72) in 1996. Four participants had Down syndrome. IQ scores were not available; however, these participants were classified as moderately and mildly intellectually disabled in 1983 (Reid et al., 1985).
Physical Fitness Battery

The same battery of tests was used in 1996 as in 1983, the Canadian Standardized Test of Fitness (CSTF; Government of Canada 1981). This is currently called the Canadian Physical Activity, Fitness, and Lifestyle Assessment. While advances in assessment of fitness for individuals with an intellectual disability have occurred since 1983 (see reviews by Pitetti et al., 1995; Reid & Montgomery, 1999; Seidl, 1998), we remained with the original battery and procedures to enable assessment of change.

The CSTF includes anthropometric measurement of standing height and weight and body fat estimates from skinfold measures at the triceps, biceps, subscapular, and suprailliac sites. Muscular strength is measured by the sum of the right and left grip-strength, and muscular endurance by the number of sit-ups and push-ups done in 60 s. Flexibility measurement in the CSTF was estimated by trunk flexion, with a modified Wells and Dillon sit-and-reach box. Cardiovascular fitness was assessed by a step test, included in the CSTF, called the Canadian Home Fitness Test. The procedures outlined in the CSTF manual were used for all tests with one exception, the step test.

The Canadian Home Fitness Test requires participants to ascend and descend two steps at a pre-established tempo heard on an audiotape. The initial tempo is determined by the participant’s age. It is possible to complete three 3-min workloads if the individual’s heart rate does not exceed a target level after each workload. This test was modified, because many participants in the original pilot study, and subsequently during data collection for the 1983 study, experienced difficulty attaining and maintaining the required stepping cadence. The modification was a simple counting of ascents and descents during each 3-min exercise bout to determine the actual stepping cadence. Maximum oxygen uptake is predicted by the following equation with the Canadian Home Fitness Test: VO₂ max = 42.5 + 16.6 VO₂ (l/min) - .12 Weight (kg) - .12 Post Exercise Heart Rate (beats/min) - .24 Age (years) (Jetté, Campbell, Monegon, & Routhier, 1976). The postexercise heart rate assumes a given cadence. Therefore, when participants stepped at a rate slower than the recommended one for their age, the oxygen requirements were interpolated from the values provided by Jetté et al. (1976). This modification has been demonstrated to be both reliable and valid (Montgomery, Reid, & Koziris, 1999).

An assistant to the first author, who had known most of the participants for 20 years, was trained on all items in the test battery. The assistant counted the number of ascents and descents on the Canada Home Fitness Test, as well as the number of push-ups and sit-ups, to measure sit-and-reach performance and observe the participants for any signs of physical stress that might have necessitated discontinuance of a particular test. A sphygmomanometer providing digital readouts of blood pressure and heart rate was used for all participants.

Procedures

In accordance with American College of Sports Medicine (ACSM) Guidelines for Exercise Testing and Prescription (ACSM, 1995), the PAR-Q questionnaire (Thomas, et al., 1992) was completed by each participant in consultation with their guardian prior to testing day. This screened out any individual who had a risk associated with exercise testing. Also, each person was asked to refrain from eating, drinking coffee, and smoking cigarettes 2 hr before testing and to avoid exercising the day of the test (ACSM, 1995).

The experimenter visited each participant in his or her home to familiarize the participants with the experimenter, who had worked with them for 6 years. This visit involved a clear verbal description and practice of each test item. In addition, blood pressure was checked. Finally, each participant was given a set of pretest instructions describing the testing and how to prepare for the testing day.

Creating an optimal testing environment for the participants was achieved in a number of ways. The temperature in the testing room at the reeducation center was maintained between 68–72° F and decorated with posters and pictures to minimize the impact of a sterile laboratory. As noted, the assistant had worked with the participants for 20 years. Finally, the guardian of each participant was present to ensure they were comfortable and relaxed.

The complete battery was administered in a session of approximately 1 hr. The sequence of the tests recommended by the CSIF operations manual and used in this study follows: (a) recording anthropometric measures of weight, height, and skinfolds, (b) hand grip strength, (c) blood pressure and resting heart rate, (d) the Canada Home Fitness Test, (e) push-ups, (f) trunk flexion, and (g) sit-ups.
Motivation has been noted as a problem when testing individuals with an intellectual disability (Seidl, Reid, & Montgomery, 1987). In addition to pretest procedures, such as a visit to their home, reinforcement was used throughout the testing for both successful and unsuccessful efforts. To remain consistent across participants, verbal encouragement (e.g., well done, good job, you can do it) was given for every completion or attempt to complete a sit-up and push-up. Verbal praise was also provided on completion of the sit-and-reach and hand grip tests. Verbal prompts (e.g., step-up, step-down) as well as verbal praise (e.g., well done, excellent) were offered throughout the testing on the step test after every 30 s of stepping. The test battery was readministered to 10 randomly chosen individuals 4 weeks after initial testing to establish temporal stability.

**Treatment of the Data**

To assess the first hypothesis that the participants’ fitness would be lower in 1996 than in 1983, a repeated measures 2 x 2 (Gender x Time) analysis of variance (ANOVA) was used for each dependent variable. Effect sizes were calculated to assess the second hypothesis that the magnitude of change in fitness would be greater for individuals with an intellectual disability than the nondisabled population. Effect sizes were determined for the participants in the study by using weighted means and pooled standard deviations. The effect size calculations for the population were made possible with the descriptive statistics obtained from the Canadian Fitness and Lifestyle Research Institute, based on data of 5,757 men and 3,445 women, as part of the Canadian Fitness Survey (Government of Canada, 1982). The term “population” is used when referring to data based on these large numbers to distinguish from data based on the current sample of 32. It is recognized that this is a somewhat liberal use of the word population. Following Thomas, Salazar, and Landers (1991) and Cohen (1988), an effect size of less than .41 is considered small, from .41 to .70 moderate, and greater than .70 large.

Small samples may cause an effect size to become positively biased (Thomas & Nelson, 1996). To obtain a virtually unbiased estimate of an effect size, a correction factor obtained with the following formula was multiplied by sample effect sizes (Thomas & Nelson, 1996, p. 299).

\[
C = 1 - \frac{3}{4(N1 + N2 - 2) - 9}
\]

where \(C\) = correction factor; \(N1\) = sample size of Group 1; and \(N2\) = sample size of Group 2.

Descriptive statistics (see Table 2) will be presented in percentiles as well as means and standard deviations. The height and weight results are compared to statistics on adults without disabilities in Canada (Nutrition Canada). The CSTF Operations Manual (Government of Canada, 1981) includes norms for the remaining variables. The 1981 norms were used for the 1983 data, while 1986 norms (Government of Canada, 1986) were used for the 1996 data. Each source provides interpretative assistance by presenting a range of scores in categories such as “below average,” “minimum,” or “above average.” These categories will be used, but always with quotes to indicate their origin.

**Results**

**Reliability**

A one-way random ANOVA model (Sarrit, 1976) was used to calculate intraclass correlations for all variables. The correlations follow: height, .99; weight, .99; percentage of body fat, .98; grip strength, .98; push-ups, .80; sit-ups, .93; trunk flexion, .85; maximum oxygen uptake, .98. The temporal stability of the data appears to be moderate to high (Glass & Hopkins, 1984).

**Height**

The descriptive statistics of height for participants in 1983 and 1996 are shown in Table 2. These group results indicated that both men (163.5 cm in 1983 and 163.7 cm in 1996) and women (155.1 cm in 1983 and 153.6 cm in 1996) with an intellectual disability were “below average” in height compared to individuals without disabilities. When height was analyzed by a 2 x 2 (Gender x Time) repeated measures ANOVA, a significant main effect resulted for both gender, \(F(1, 28) = 5.96, p < .02\), and time, \(F(1, 30) = 28.36, p < .001\). The interaction was not significant. As expected, the men were taller than the women. The main effect for time resulted from both genders being significantly shorter in 1996 than in 1983, but the magnitude of this change was small, as indicated by the effect size of the male (.15) and female samples (.14; see Table 3). The magnitude of the change in the population height was also small for both genders, indicating that the loss in height of those with intellectual disabilities was no different from the general population.

**Weight**

The statistics for weight (see Table 2) indicate that both men and women were described as “below average” in 1983 and “average” in 1996. The 2 x 2 (Gender x Time) ANOVA produced a significant effect only for time, \(F(1, 30) = 5.88, p < .02\). This resulted from both men and women gaining weight over the 13-year period. The sample and population effect sizes were small for both
genders (see Table 3), indicating that the change in weight from 1983 to 1996, while significant, was not large. They also demonstrate that the magnitude of change in the sample of individuals with an intellectual disability was similar to the change in the general population.

**Body Mass Index**

Body mass index (BMI) has been used as one method to assess body weight relative to height. Given that height remains relatively constant for adults, an increase in BMI may result from increases in body fat or muscle mass. The mean score of the women for BMI was 24.4 in 1983 and 27.0 in 1996, (see Table 2) both of which are described as “below average.” BMI for men also remained quite consistent over time, with 23.4 in 1983 and 25.1 in 1996, an “average” weight relative to height.

The 2x2 (Gender x Time) ANOVA yielded a significant effect for time only, F(1, 30) = 14.58, p < .001. Both men and women increased significantly in BMI over the 13-year period. The effect sizes of .52 and .42, for men and women, respectively, are moderate compared to the small effect sizes for the population (.23 and .31, respectively). This suggests that the significant change in BMI for participants with an intellectual disability was greater than that expected in the general population.

**Body Fat**

Table 2 indicates that the average percentage of body fat for men was 18.9% in 1983 and 24.4% in 1996. These were described as “average” and “above average,” respectively. The women had 29.6% in 1983 and 37.4% in 1996, with both percentages described as “obese.”

The 2x2 (Gender x Time) ANOVA produced a significant effect for gender, F(1, 26) = 46.9, p < .001, and time, F(1, 26) = 34.09, p < .001. These results were due to the women having more body fat than the men, but both groups showed a significant increase in body fat from 1983 to 1996. The effect sizes with regard to adiposity in the population are small, suggesting that any increase in body fat, even if significant, should be fairly small. Yet, the sample effect size for the men (1.05) and women (1.50) indicates that the significant main effect for time was large and meaningful. Moreover, because the effect sizes for the population are small but large for the sample, individuals with intellectual disabilities in this study gained body fat at a much greater rate than expected in the non-disabled population.

**Grip Strength**

The grip strength for men was 48.3 kg in 1983 and 59.3 kg in 1996, while for women it was 17.9 kg in 1983 and 36.1 kg in 1996 (see Table 2). When these figures are compared to the CSTF norms, all scores are described as “poor.”

The 2x2 (Gender x Time) ANOVA produced significant main effects for both gender, F(1, 30) = 17.17, p < .001 and time, F(1, 30) = 56.51, p < .001. These findings resulted from the men scoring higher than the women but from both genders being stronger in 1996 than 1983. This latter result was unexpected and contrary to patterns of strength as people age (Government of Canada, 1982; Spiriduso, 1995). The instrument used to assess grip strength in 1996 was the same model as used to record data in 1983 and calibrated prior to use in 1996. Moreover, an intraclass correlation of .98 was obtained after retesting 10 participants in the 1996 portion of the study. The unexpected increase in scores from 1983 and 1996 is difficult to explain, but some measurement error is assumed. Therefore, the effect sizes for the grip strength data were not calculated.

**Push-ups**

The mean number of push-ups for men was 13.7 in 1983 and 11.6 in 1996 (see Table 2). These results are

<table>
<thead>
<tr>
<th>Variable</th>
<th>1983</th>
<th>1996</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>165.2</td>
<td>12.2</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>64.8</td>
<td>13.8</td>
</tr>
<tr>
<td>Body mass index</td>
<td>23.4</td>
<td>2.6</td>
</tr>
<tr>
<td>Body fat (%)</td>
<td>18.9</td>
<td>4.7</td>
</tr>
<tr>
<td>Grip strength (kg)</td>
<td>48.3</td>
<td>21.0</td>
</tr>
<tr>
<td>Push-ups (#)</td>
<td>13.7</td>
<td>7.8</td>
</tr>
<tr>
<td>Sit-ups (# in 60 s)</td>
<td>11.7</td>
<td>12.8</td>
</tr>
<tr>
<td>Trunk flexion (cm)</td>
<td>22.9</td>
<td>9.5</td>
</tr>
<tr>
<td>Predicted maximum oxygen uptake (ml/kg-min)</td>
<td>36.2</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>156</td>
<td>ROES: June 2000</td>
</tr>
</tbody>
</table>
described as “below minimum.” The mean number of push-ups for females was 11.7 in 1983 and 12.4 in 1996, both described as “minimum.” There were no significant findings for gender, time, or gender and time interaction from the 2 x 2 ANOVA. Finally, all effect sizes were small (see Table 3), indicating that the magnitude of change over time for push-ups in the sample of individuals with an intellectual disability reflects the change in the general population.

**Sit-ups**

Men were able to complete 11.7 sit-ups in 60 s in 1983 and 8.1 sit-ups in 1996. Women completed 10.6 sit-ups in 1983 and 5.8 in 1996 (see Table 2). All performance scores are described as “poor.” The 2 x 2 (Gender x Time) ANOVA demonstrated a significant effect only for time, \( F(1, 30) = 6.53, p < .01 \), indicating that both genders decreased in the number of sit-ups from 1983 to 1996. Both the sample (-.33) and population (-.56) of men were similar in effect size (see Table 3). The women in this study had a medium effect size of -.69, while the expected effect size in the population is -.23. These data indicate that the decline in abdominal muscular endurance for women with an intellectual disability was greater in the sample than in the population.

**Trunk Flexion**

In 1983, the men had a mean flexibility score of 22.9 cm, while in 1996 it was 23.3 cm (see Table 2). The women scored 22.7 cm in 1986 and 26.2 cm in 1996. These were described as “below average” (1983) or “below minimum” (1996). The 2 x 2 (Gender x Time) ANOVA did not yield any significant findings. Effect sizes were not calculated for flexibility. Because the mean scores of the sample demonstrated an improvement in flexibility, although nonsignificant, and the population means demonstrated a decrease in flexibility, it would have been meaningless to calculate effect sizes and then discuss magnitude of change.

**Table 3. Population and sample effect sizes of change on the standardized test of fitness: 1983–1996**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Population</th>
<th>Sample</th>
<th>Women</th>
<th>Population</th>
<th>Sample</th>
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</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td>-.11</td>
<td>-.15</td>
<td>-.09</td>
<td>-.14</td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>.14</td>
<td>.22</td>
<td>.26</td>
<td>.29</td>
<td></td>
</tr>
<tr>
<td>Body mass index</td>
<td>.23</td>
<td>.52</td>
<td>.31</td>
<td>.42</td>
<td></td>
</tr>
<tr>
<td>Body fat (%)</td>
<td>.13</td>
<td>1.05</td>
<td>.28</td>
<td>1.50</td>
<td></td>
</tr>
<tr>
<td>Push-ups (no.)</td>
<td>-.40</td>
<td>-.28</td>
<td>-.15</td>
<td>.08</td>
<td></td>
</tr>
<tr>
<td>Sit-ups (# in 60 s)</td>
<td>-.56</td>
<td>-.53</td>
<td>-.23</td>
<td>-.69</td>
<td></td>
</tr>
<tr>
<td>Predicted maximum oxygen</td>
<td>-.87</td>
<td>-.60</td>
<td>-.67</td>
<td>-1.02</td>
<td></td>
</tr>
<tr>
<td>uptake (ml/kg-min)</td>
<td></td>
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</table>

**Predicted Maximum Oxygen Uptake**

The predicted maximum oxygen uptake scores are shown in Table 2. One male participant was unable to complete the step test in 1996 due to a weakness in one leg. One woman refused to continue after starting the test and another was unable to follow the stepping pattern after 30 min of instruction. The 1983 data were complete for all participants.

The mean predicted VO\textsubscript{2}max (ml/kg-min) for men was 36.2 in 1983 and 33.7 in 1996. For women it was 30.0 in 1983 and 26.3 in 1996. All these scores are described as “poor.” The 2 x 2 (Gender x Time) ANOVA showed significant main effects for gender, \( F(1, 28) = 28.42, p < .001 \) and time, \( F(1, 11) = 11.43, p < .002 \). The interaction was not significant. The gender effect indicates that the women had a significantly lower level of cardiovascular fitness than men in both 1983 and 1996. In addition, participants decreased in VO\textsubscript{2}max from 1983 to 1996.

Table 3 indicates that the men had a medium effect size (.60) compared to a large effect size (.87) expected in the nondisabled population. On the other hand, the women in this study had a large effect size (.70) compared to a medium effect (.70) expected in the population. These data indicate that women with an intellectual disability had a greater decline in cardiovascular fitness than expected for females without a disability.

**Discussion**

**Anthropometric Measures**

The height of the male and female adults in this study was described as “below average” in 1983 and 1996. This finding is consistent with other studies of intellectual disability (e.g., Nordgren, 1971; Reid et al., 1985; Rundle & Sylvester, 1973). Both genders decreased in height over time, but the magnitude of this effect was small. Men typically show a slight decrease in height after the age of 30 years, while women may show some loss in height as early as 16 years (Spirduso, 1995). In later years, women are expected to show a greater height loss than men due a higher prevalence of osteoporosis. However, in this study women appear to have lost height at the same rate as men, as evidenced by similar effect sizes.

Participants were described as “below average” in weight in 1983 and “average” in 1996. These descriptors must be interpreted with caution, because they are derived from individuals without disabilities who are somewhat taller. Nonetheless, they showed a significant although small increase in weight over the 13 years. It is common for weight to increase until the age of 50 years (Spirduso, 1995). Weight increase may result from a number of factors such as an increase in muscle mass or increase in body adiposity. Therefore, the findings from
BMI and percentage of body fat must be viewed in conjunction with changes in weight. In fact, the changes in BMI were significant and moderate over 13 years for both men and women with an intellectual disability. Also, the magnitude of this change was greater than expected in the non-disabled population. In addition, the significant increase in body fat for both genders produced large effect sizes (1.05 in men and 1.5 in women), while they are expected to be small in the general population. Collectively, therefore, while individuals with an intellectual disability may not be described as obese compared to taller non-disabled groups, they gain more weight relative to their height as they age, and this is largely the result of a greater increase in body fat.

Fox and Rotatorii (1982) and Rimmer et al. (1993) showed that people with an intellectual disability have a tendency toward obesity. While some increase in body fat is typical during middle age, the present data demonstrate that this increase was much greater among the participants of this study when compared with non-disabled persons. It is likely that individuals with an intellectual disability have a greater risk of certain health risks such as coronary heart disease and Type II diabetes (Shephard, 1990). In addition, the problem of adiposity is particularly acute among women with an intellectual disability. They were described as obese in 1983 and 1996, and the effect size of 1.5 suggests that they were accumulating fat at an alarming rate.

Muscular Endurance

Age-related changes are more subtle and gradual for muscular endurance compared to other physical fitness performance variables (Government of Canada, 1981). The results showed a significant and moderate decline for sit-ups over the 13 years but almost no change in push-ups. Disuse can erode endurance of certain muscle groups. Most of the participants worked on assembly lines, where they sat for most the day but used their arms and shoulders. They had little opportunity to use the muscles in the trunk area. This may explain the performance differences for the sit-ups and the push-ups. While the pattern of age-related changes in performance were different for push-ups and sit-ups, the absolute number of push-ups was still described as "minimum" for women and "below minimum" for men. Similarly, the number of sit-ups was "poor" for both genders. These findings are consistent with other explorations of muscular endurance and intellectual disability (Reid et al., 1985).

The effect size (-.09) of the change in muscular endurance for women performing sit-ups was considerably greater than expected in the non-disabled population (-.23). With the men, the change in the sample with age (-.53) was similar to the population (-.53). This may indicate that women lose muscular endurance in the abdominal region at a faster rate than men.

Cardiovascular Endurance

The description of "poor" performance for predicted maximum oxygen uptake in 1983 and 1996 suggest that the participants had inferior cardiovascular fitness compared to persons without a disability. This is consistent with a number of investigations (e.g., Pitetti & Tan 1991; Rimmer et al., 1993).

The women performed significantly lower than the men on the step test. Cardiovascular efficiency is related to muscle mass (Shephard, 1987a). Men have a greater muscle mass than women and, thus, a greater capacity to use the oxygen needed during aerobic endurance activities. In terms of aging, muscle mass also directly affects cardiovascular performance. Women lose a higher percentage of muscle mass as they age than men (Spirduso, 1995), which may explain, in part, women's lower performance on cardiovascular endurance tests.

Cardiovascular endurance is expected to decline during middle age. While changes in muscle mass may partially explain this phenomenon, a reduction in physical activity will also reduce cardiovascular endurance. It is likely that individuals with an intellectual disability are less active than individuals without disabilities (Hoge & Dattilo, 1995). While the men demonstrated a significant and moderate decline (effect size -.60) in cardiovascular endurance, it was not as large a decline as in the general population (effect size -.87). It is possible that the small sample of 18 men were relatively active compared to the general population. Yet, the men were already low in cardiovascular fitness in 1983, and, coupled with the moderate effect size of -.60, there is sufficient reason to be concerned with their cardiovascular fitness. The women, however, had a greater magnitude of decline in cardiovascular fitness (effect size -1.02) compared to the general population (effect size -0.67). This may be related to a more sedentary lifestyle during middle age than the men and their tendency to gain more body fat than women in the general population.

Existing empirical data have established that individuals with an intellectual disability as a group have a lower level of fitness than the general population (e.g., Fernhall, 1993; Pitetti et al. 1993; Reid et al. 1985). The present data replicate this robust finding, as group performance on almost all fitness variables were in the "below average" or "poor" categories. We also hypothesized that the physical fitness of the individuals with an intellectual disability would be lower in 1996 than in 1983. The results of the repeated measures ANOVAs indicated a significant decrease in fitness in all areas except flexibility, muscular strength, and the muscular endurance test of push-ups. Change in fitness across middle age in people without a disability support this general decline (Shephard, 1987b; Spirduso, 1995). However, because their fitness was already very low, they appeared to be falling to a level that places them at risk for disease and...
loss of independence. Assuming a sedentary lifestyle, minimal knowledge about the debilitating effects of poor physical fitness, and an inability to take control of personal health needs (Pietetti et al. 1995), the current data provide a strong signal for health professionals to promote fitness and physical activity programs for these individuals. Loss of independence and disease will have a profound impact on those affected and will require additional health services, both human and financial. A preventative plan of physical activity would seem imminently sensible.

We also hypothesized that the magnitude of change in fitness of adults with an intellectual disability would be greater than the change expected in the nondisabled population. The effect sizes provided this insight. For example, if the expected change in the population over 13 years was small (effect size <.41), but the sample produced a moderate change (effect size ranged from .41 to .70), then we concluded that the magnitude of change was greater in the sample than the population. Of course, the magnitude of change would be even greater if the population change was small and the sample change was large (effect size >.70).

Such differences in magnitude were evident with BMI and percentage of body fat. Increased adiposity was clearly occurring at a faster rate in the sample of individuals with an intellectual disability than in the general population. It is particularly alarming that the women produced an effect size of 1.5 for percentage of body fat. In addition, the magnitude of change in sit-ups for the sample of women was moderate, compared to small for the population. Finally, the change in predicted maximum oxygen uptake for the women was large, compared to a moderate change expected in the population. This is also a finding of considerable concern, because cardiovascular fitness may be directly related to the ability to perform daily living tasks (Jette, Sidney, Quenneville, & Landry, 1992). Therefore, it is concluded that the magnitude of change in fitness over 13 years is greater for people with intellectual disabilities than the nondisabled population with respect to BMI and percentage of body fat. In addition, change was greater for women for sit-ups and predicted oxygen uptake.

In conclusion, the participants in this study generally scored low on all measures of physical fitness compared to the nondisabled population and demonstrated a significant decline over 13 years on measures of body fat, BMI, sit-ups, and predicted maximum oxygen uptake. Moreover, the decline of fitness parameters was greater in our sample of men and women with an intellectual disability than in the nondisabled population for BMI and percentage of body fat, and it was greater among the women for sit-ups and oxygen uptake. Health professionals and government agencies have been concerned with the fitness and physical activity levels of middle-aged adults for many years. It would appear that those with an intellectual disability are a particular population at risk through middle age.

References


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