

THE RELATIONSHIP BETWEEN HIGH DENSITY LIVING  
AND FITNESS PERFORMANCE OF ELEMENTARY  
SCHOOL AGE CHILDREN

by

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## ABSTRACT

The purpose of this study was to compare the motor performance and physical fitness of children living in a high density area to that of children living in a low density area.

It was hypothesized that children from the Vancouver West End score lower than children from Vancouver and children from Canada on the Canadian Association of Health, Physical Education, and Recreation (CAHPER) Fitness Performance Test; that children from apartment floors four to twenty score lower than children living below the fourth floor on the CAHPER Fitness Performance test and the Crawford and Virgin tests; and that there is no difference between the motor performance scores of the children from the West End and the motor performance scores of the children from North York.

The elementary school population of the Vancouver West End district was selected to be tested on motor performance and physical fitness test items. The CAHPER Fitness Performance Test and a battery of tests previously used by Crawford and Virgin in North York Ontario were used in the testing. The scores recorded were then compared to the Vancouver CAHPER norms, the Canadian CAHPER norms and the test scores recorded by Crawford and Virgin in their North York study. The findings indicated that West End elementary school age children score lower than Vancouver elementary school age children on the CAHPER Fitness Performance test;

that the children living in the West End fall behind their peers in Vancouver in leg power and speed between the ages of seven and twelve; that the girls from the West End do not develop in their agility and cardiovascular endurance at a normal rate; that there was no difference between the scores of the children living on floors one to three and the scores achieved by children living on floors four to twenty; that no difference was found in the motor performance scores of children living in the West End and the scores of the children from North York; that the Fitness Performance scores improve as a child grows older at least to the age of twelve; and that males score higher than females on the CAHPER Fitness Performance test at the same age level.

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## CHAPTER I

### INTRODUCTION TO THE PROBLEM

#### Introduction

In recent years many families have been moving into multiple unit dwellings which are being constructed near or within easy access to their places of work. The city of Vancouver is no exception; 96.8 percent of the residences of the Vancouver West End are multiple family dwellings. This increase in the population density of the West End has heavily taxed the few parks and playgrounds within the area. Therefore, many children raised in this section of the city have difficulty finding an adequate play environment.

It has been stated that parents who live in apartments are often hesitant about permitting their children to go out and play unaccompanied (Darke and Darke, 1970). The distance the family lives above the ground is a factor in this as are the methods used to get to the ground. Apartment buildings with more than three stories are equipped with elevators and therefore the use of the stairs by the residents is limited. In a recent study, Crawford and Virgin (1971) found in the City of North York that children from high rise apartments showed less development than their peers from single family dwellings, on several fundamental motor tasks.

If children are forced to live a more restricted life

in terms of play experiences and overcrowded environments inhibit play (Holme and Massie, 1970), one could assume that the motor performance and general fitness levels of the children would be retarded.

This study, then, will deal with the present fitness and motor performance levels of Vancouver's West End Elementary school children.

#### Statement of the problem

The purpose of this study was to compare the motor performance and physical fitness of children living in a high density area to that of children living in a low density area.

#### Sub problems

1. To compare the CAHPER Fitness Performance test scores achieved by children from the West End with the Vancouver norms for the CAHPER Fitness Performance test.
2. To compare the CAHPER Fitness Performance test scores achieved by children from the West End with the Canadian norms for the CAHPER Fitness Performance test.
3. To compare the Fitness and motor performance scores of children living below the fourth floor to the scores of children living on and above the fourth floor.
4. To compare the motor performance scores from the West End with the scores from North York.

#### Definitions

West End - that area in the city of Vancouver bounded by

Burrard Street, Robson Street, and Stanley Park

CAHPER - The Canadian Association of Health, Physical Education and Recreation.

CAHPER Fitness Performance Test - a six item test designed to measure physical and motor fitness.

Motor Performance - is a relatively short term aspect of movement behavior marked by movement oriented toward the execution of an identifiable task. It is goal-centered purposeful, measurable, observable movement behavior of relatively short duration.

Crawford and Virgin Test Items - stork stand, agility run, ball throw, jump and clap, alternate wall toss, and toe touch.

North York - a municipality north of Toronto.

High rise building - a building which is over three floors in height and contains an elevator.

YMCA - Young Men's Christian Association.

Single Family Dwelling - a building where only one family lives under one roof.

Multiple Family Dwelling - a building where more than one family lives under one roof.

Multiple Unit Dwellings - a building containing more than one living unit under one roof.

High Density Area - a residential area where more than 100 persons live on one acre.

Low Density Area - a residential area where fewer than 50 persons live on one acre.

## Delimitations

The sample will consist of the students of Lord Roberts Elementary School and School Annex in the City of Vancouver.

## Assumptions and limitations

The test items of Crawford and Virgin (1971) will be assumed to be reliable.

It is assumed that the total population of children in the West End live in multiple family dwellings.

## Hypothesis

1. Children from the West End score lower than children from Vancouver on the CAHPER Fitness Performance test.
2. Children from the West End score lower than children from Canada on the CAHPER Fitness Performance test.
3. Children from apartment floors four to twenty score lower than children living below the fourth floor on the CAHPER Fitness Performance test and the Crawford and Virgin tests.
4. There is no difference between the motor performance scores of the children from the West End and the motor performance scores of the children from North York.

## Significance of the Study

The study could have some important implications for the need of better recreation facilities in the immediate area of multiple family dwellings and perhaps bring out some severe disadvantages of having families live in such buildings.

The developers of these complexes might be interested in what effect their structures are having on the children raised within their walls. The schools in these areas may have to initiate special programs to compensate for the influence of the environment. It is possible that the Federal Government would be interested in the findings and require certain adequate play areas for every "X" number of families. Also, parents living in such complexes may be very interested in the implications attached to living in multiple unit dwellings.

## CHAPTER II

### REVIEW OF LITERATURE

In the past ten years the housing trends in North American cities are forcing families to seek living accommodation in multiple unit forms of accommodation (Katz, R.D., 1963). It has been predicted that in the Province of British Columbia in the near future most new home construction will be of the multiple unit nature due to the pressing financial and ecological situations. With this increased premium on open space or available land within urban areas the question arises regarding the effect this style of life will have on the individuals living in such environments.

Much concern is being expressed recently on the housing of families with young children in high flats in relation to lack of social contacts, health, future well-being and strain on family life. It is in the area of motor and physical development this review shall concern itself.

"The empirical evidence is quite sparse . . . most of the comment is pure speculation and there is an urgent need for careful research into the effects of high buildings, especially if these are going to form the basis of future housing policy in inner areas of cities". (Darke, J. and Darke R., 1970, p. 7).

Cities generally have not kept up in providing parks

and playgrounds and other open spaces to compensate for the absence of usable open space for the children living in multiple unit dwellings built on small lots.

"Generally in the development of such projects (high rise), no consideration has been given to schooling, playgrounds, shopping centers, and other community services associated with family accommodation." (Canadian Housing Design Council, 1964, p. 4). This means that "both the children and their parents are underprivileged when the children do not have direct and immediate access to the ground, playgrounds of adequate size and basic equipment, and some sheltered play space within attractive range . . . the high rise building does have its merits, but not for active children" (Dodge, 1958, p. 16).

The advantages and disadvantages of highrise living as summed up by Townsend (1970, p. 7); Kamenka (1947, p. 113); and Dodge (1958, p. 18) are as follows:

<u>Advantages</u>	<u>Disadvantages</u>
better views	no access to open space
privacy	isolation
less noise	children's safety
fresh air	1. balconies (rails too low)
organized child welfare	2. lifts
	3. staircases
favors group activities	lack of recreation space
fine lighting	and a difficulty of
feeling of space	supervision

It can be seen that there are both advantages and



disadvantages to living in high rise accommodations. Some writings even state that small families with children under the age of two do not need the same access to the out-of-doors as older families and apartments are superior for them (Dodge, 1958, p. 18). This may well be the case but how many apartments will accept families?

In a Metropolitan Toronto study, Toronto, Ontario (1961) it was reported that 75 percent of the buildings would rent to families with children. Also 25 percent of all apartment households are occupied by families with children and the percent of apartments occupied by families with children increases steadily with the distance from the city center. The mean number of children per 100 suites is 33 with 47 percent being pre-school age, 40 percent being elementary school age and 13 percent being of secondary school age (Metro Toronto Plan Board Apartment Survey, 1961).

In Vancouver a survey of the West End District (1971) indicated that there were 2,050 children between the ages of 0 and 14 years out of a population of 37,728. This represents 5.4 percent of the West End population compared to 27.2 percent of the Canadian population (Statistics Canada, 1974) occupied by 0-14 year olds. The place of residence for the majority of these children was apartment blocks as 96.8 percent of all residences are apartments. Only 2 percent of all living units are single detached homes occupied by several families. However the West End Housing Agency indicates that there is a significant decrease in the numbers of available

suites for parents with children and presently (October 1975) they are aware of only two to three buildings which will rent to parents with children. A spot check on the numbers of suites available revealed eight out of 80 (10 percent) will accept children but with restrictions on age and number.

New planning restrictions have been passed by Vancouver City Council and future development will be much more acceptable for families planning to live in the West End. However with these new restrictions, contractors tend to prefer not to build residences but opt to build office buildings in the city center. This has led to a significant decrease in the number of children of elementary school age. One elementary school on the border of the West End was closed in 1971 sending all children to Lord Roberts Elementary School and Annex and if the trend continues, families with elementary school age children may be completely forced out of the West End.

Presently the length of residence in each unit is of short duration:

- residence less than one year      40.4 percent
- residence one to two years      23.4 percent
- residence three to five years      14.5 percent
- residence six to ten years      13.0 percent
- residence over ten years      8.7 percent

However, inter area moves reveal a truer idea of how long people live in the area:

- no inter area move in five years 57.4 percent
- one inter area move in five years 18.5 percent
- two to three inter area moves in five years 15.0 percent
- four or more inter area moves in five years 9.1 percent

These figures indicate several things:

1. Most people prefer to stay in the West End and move within the area to a more preferred suite or unit.
2. There is a good number of moves taking place within the community.
3. While the population is mobile it is more static than it first appears.

#### Quality of Life

The quality of life in a high rise complex is directly affected by density, building type, and size. As a rule, as density increases, individual privacy decreases. However, Katz (1963) states that buildings can be used as buffers against heavy traffic and therefore provide safe and quiet play areas within court yards. He also mentions the need for adequate light and fresh air for all units. This is something we see being emphasized more and more in structures these days.

The number of individuals per acre is an accepted guide for density and while there are not strict standards, figures from 25 persons per acre to 400 persons per acre are quoted in the literature; for example, a town 1.25 miles in radius at 35 persons per acre would house 60,000 people; a town 0.94 miles in radius at 160 persons per acre

could accommodate the same 60,000 people. Le Corbusier (Jensen, 1966, p. 12) long ago accepted 300 persons per acre net in the residential areas. Presently many North American cities have set between 200 and 300 persons per acre as their maximum desirable density (Milwaukee, Toronto, New York, Philadelphia, Winnipeg, Seattle, Sacramento and Vancouver). The Vancouver West End has a density number of 149 (1973) per acre and plans in the future indicate this figure should not change significantly (Table I).

It is mentioned by Brechenridge and Lee (1966) that the basic principles of healthy housing can be put under a) meeting psychological and physiological individual needs, b) protection against contagion, c) protection against accidents. "Meeting physiological needs involves temperature regulation, ventilation, light protection against excessive noise, and provision of adequate space for exercise and for childrens' play" (Brechenridge and Lee, 1966, p. 173). Most of these can be achieved if proper planning precedes the building development, however, it was found from medical observations that children living in flats had twice the incidence of respiratory infections as children living in houses (Hird, 1966; Darke, J. and Darke, R., 1970, p. 11). Hird also observed a small but steady increase in rate of respiratory infection incidence ". . . with increasing height above the ground" (Darke, J. and Darke, R., 1970, p. 11). This supported Hird's hypothesis of people's need of access to the open air. Further evidence by Hird revealed lower

Table 1  
Vancouver West End Population  
Density by Area

Neighbourhood Areas	1973 Popu- lation	Net Residential Acres	1973 Density	Proposed Maximum Density 1988
Stanley Park	8,700	50	174/acre	200/acre
Coal Harbour	2,300	32	71/acre	100/acre
King George	3,300	23	143/acre	150/acre
Lord Roberts	6,050	45	134/acre	150/acre
Alexandra Park	5,050	26	194/acre	200/acre
New Crystal Pool	7,250	49	148/acre	175/acre
Nelson Park	2,550	15	170/acre	150/acre
Robson International	5,450	34	160/acre	200/acre
Total	40,650	274	$\bar{x} = 149/\text{acre}$	$\bar{x} = 166/\text{acre}$

(West End Planning Team, Aug. 1973)

physical activity among flat dwellers (Darke, J. and Darke, R., 1970, p. 11). It is stated in many studies that much of what is good or bad about living in apartments depends specifically on the people in residence. The socializing agent may be the structural design or the length of time of residence but more often than not the social norms of an apartment are influenced by one or two individuals or families. They tend to set the norms and can perform a valuable leadership role in stimulating social interaction and physical activity among the other residents. However, "The important thing is to recognise that the beneficial social effects of good housing conditions can be largely cancelled out if there is nowhere children find it enjoyable to play" (Minister of Housing and Local Government, 1959, p. 44).

#### Values of Play

Lawrence Rarick stated "There are few informed persons today who question the value of physical activity and play in the life of the child and adolescent" (Rarick, 1961, p. 4).

These values he lists as:

1. satisfaction of the urge for activity
2. stimulant to physical growth
3. promotion of organic vigor
4. development of a repertoire of neuro-muscular skills
5. broadening one's concept of self
6. provision of a medium for socialization.

Elizabeth Hurlock (1964) states that play:

1. helps the child develop as a person
2. promotes muscular development
3. is an outlet for energy
4. is an education tool in motor development
5. is a socialization experience.

Play for children is important and very crucial in their total development. However we in city centers are presently asking ourselves where can our children play?

A goal to work towards is "The provision of play spaces must be one of the first calls on the available space around dwellings in multi-story developments which do not have gardens of their own, though it is usually impractical for major playgrounds, such as are provided in public parks, to be included on a high density estate" (Ministry of Housing and Local Government, 1958, p. 44). This is definitely a goal to work towards as a study conducted in London, England by J. Maisels mentions ". . . seventy of the sample (200) made direct or indirect reference to the difficulties of children's play in flats and fifty-eight percent of the sample thought that their present environment was detrimental to mother and child" (Darke, J. and Darke, R., 1970, pp 8-9) by restricting their play experience and availability to open areas. Also, of the population of children under four years, only 5 percent were allowed downstairs alone but it was found lower floor mothers allowed their children to go downstairs alone more often. It is very interesting to note that

"a quarter of the comments were that children could not play downstairs alone" (Darke, J. and Darke, R., 1970, p. 8).

Thus the small children went out only when accompanied by mother and played rarely with other children. Upon checking previous day activities it was found that few children had been out to play, one in eight had not left the flat and most of those who had gone out had done so for a short time and had done so with mother when she went shopping. Generally it was found that seven years was the age when mothers allowed children to play outside unsupervised. However it has been stated that it is the facilities available and the individual mother involved which determines whether the child goes out to play no matter what floor he or she lives on (first or fiftieth). This study and others indicate that the child will get adequate socialization despite the deficiencies of the housing environment if the mother's concept of her role is such that she often takes her child outside to play.

Some comments on the play opportunities for children living in multiple unit housing:-

"Play is a constant happening, a constant creation in the mind or in practice. The smaller the child, the more narrow the circle in which it moves but even older children spend most of their playing time within a radius of rarely more than 300 meters from home. Remember that when planning for playgrounds that playgrounds must be within easy reach (Bengtsson, 1970, p. 24).

"Young children, under eight or so, living in high density areas, run two major risks: loneliness and the perils of motor traffic (Lady Allen of Hurtwood, 1968, p. 12).

"Small children soon become big children" (Bengtsson, 1970, p. 47).



"The greatest respect is accorded what is most boring (Cocteau in Lady Allen of Hurtwood, 1968, p. 15).

"Tensions destroy play and overcrowding, congested environments are likely to produce tensions. Such environments are continuously forcing children into situations, both inside and outside the home, which inhibit play. An environment which provides more opportunity for play must be a better environment (Holme and Massie, 1970, p. 68).

"Children who tend to be nervous and high strung inevitably have less control over their movements than those who are more relaxed (Hurlock, 1964, p. 201).

### Motor Skill Development

The development of motor skills in children follow a fairly predictable sequence at fairly predictable times if the child has opportunity to experiment and discover in its environment. The United Nations Declaration Principle #7: "The child shall have full opportunity for play and recreation which should be directed to the same purpose as education" (Bengtsson, 1970, p. 89).

Mike Ellis, Ex-director of the University of Illinois Children's Research Center Motor Performance and Play Research Laboratory at the Urbana-Champaign campus stated in a recent newspaper article that he believes the studies show that the early play environment is of crucial importance for children. He believes challenging play surroundings appear to be a necessity for the best possible development of youngsters.

Rarick (1961, p. 4) and Hurlock (1964) support Ellis in their writings on the values of play and Clarke and Clarke (1963, p. 115) write that "The elements that contribute to neuromuscular skill are principally strength, power, speed, agility, accuracy, form, rhythm, and balance." Participation

in physical activity is necessary to develop the above elements and only with practice can the sequence of the components which make up the motor skill be learned. Clarke and Clarke (1963) further write that children who do not have the physical fitness to learn the skills through required prolonged practice are unable readily to learn and are in "difficulty in day to day personal adjustments with others and in developing active social habits and attitudes" (p. 105). However, extra practice before a child's nervous system is developed will not permit him to walk, sit, talk or acquire other skills before the neural development takes place. "On the other hand delay in the acquisition of skills may be caused by depriving the child of opportunities to practice them when sufficient maturation has occurred" (Illengworth in Lady Allen, 1960, p. 12).

It is between the ages of two to six that all of the general locomotor patterns are perfected and a number of hand-eye coordination actions are learned (Espenshade and Eckert, 1967). For example:

- Walking - age four adult style walk
- Running - age four-five stop, start, turn
- Jumping - age two and one half, two feet to take off  
age three - standing broad jump
- Throwing - age four - 20 percent throw well  
age five - 74 percent throw well  
age six - 84 percent throw well
- Catching - age four - 29 percent catch well

age five - 56 percent catch well

age six - 63 percent catch well

(Espenshade and Eckert, 1967).

It is critical that children have acquired a basic repertoire of motor abilities before the sixth year as during the years six to twelve, slow developmental change occurs but times of rapid learning take place (Goodenough, 1945). Body proportions also remain relatively stable between ages six to twelve so the child can concentrate on perfecting motor skills during these years when these skills play a significant role in his acceptance with his peers.

Research shows that most of life's important motor skill development is refined in the elementary school years and it is therefore critical to provide children of this age with adequate environments for these skills to be fully developed.

## CHAPTER III

### METHODS AND PROCEDURES

#### The Sample

##### West End

A single sampling of an elementary school population was conducted in Lord Roberts School and Annex in the Vancouver West End District. Lord Roberts School and Annex are the only elementary schools in the West End and therefore contain the total population of elementary school age children. The West End District is a densely populated area with 96.8 percent of the residences being apartments. It offered an excellent population of students to survey since the investigator was interested in the relationship between living in a high density area and the fitness and performance scores achieved by the students living there.

The data was collected during the school's physical education class time in the fall and winter of 1972 by the investigator and two Associate Physical Directors of the Vancouver Downtown YMCA. The equipment used for the testing was supplied by the YMCA and the University of British Columbia School of Physical Education and Recreation. The population of Lord Roberts School and Annex numbered 600 and 477 students from grades two to seven were tested on the fitness performance test. There were 99 children from grade

one and 68 children from grade five who completed the Crawford and Virgin test battery. The age range of the children tested was six to twelve.

#### Vancouver

The Vancouver sample consisted of CAHPER Fitness Performance Test results of 480 elementary school students randomly chosen from a set of approximately 10,000 results. There were 40 results randomly taken for each age level and sex using a mathematical random table (Selby, 1967). The 10,000 results belonged to the YMCA school testing program which is a yearly service the YMCA offers to each Vancouver elementary school. The results sampled had been completed the previous spring. There was no previous data in Vancouver on the Crawford and Virgin test items.

#### Canada

The Canadian data was gained from the CAHPER Fitness Performance Test Manual. This manual was written in 1965-1966 and represented a random sample of fitness and performance test scores of Canadian children between the ages of 7 to 17 years. There were approximately 500 boys and 500 girls tested in each age group and the norms were established on this base. This investigator used the 50th percentile score as the mean score for comparison purposes (CAHPER, 1966).

#### North York

Motor performance scores were available from Crawford and Virgin (1971) on elementary school age children grades one

to five. It was felt that test results gained from the West End population would be of interest because of the high density nature of the West End. Also the North York data was the only study the investigator could find of a similar nature. It was for this reason that the tests were repeated on the elementary school children of the West End.

### Testing Procedures

#### CAHPER Fitness Performance Test (1966)

The CAHPER Fitness Performance Test was chosen because of the Dominion wide norm data which was readily available for comparative purposes and the fact that the test items are tests of fitness performance. In fact the CAHPER Fitness Performance Test has been used for five years by the Canadian Department of Health and Welfare as part of a National awards program to provide fitness data and to motivate Canadian children to develop and maintain good lifetime fitness habits. This program has been wide spread and has proven a real benefit to physical fitness programs in Canada. Therefore the test items were familiar to the students of Lord Roberts School because of the city wide YMCA testing program initiated in 1971. However, preceding each test item with each class, a complete description of the test and a demonstration of each test item was given.

The following test items were administered in the gymnasium: the one minute speed sit-ups, the standing broad jump, the shuttle run, and the flexed arm hang. The 50 yard run and the 300 yard run were administered in the school yard.

The test administration took three gym periods per class; one for the one minute speed sit-ups, the broad jump and the shuttle run; one for the flexed arm hang, the 50 yard run and the 300 yard run, and one to test those missing a previous period due to absence.

In the one minute speed sit-ups the partner and the participant both counted the number of sit-ups completed by the participant and the tester observed rates and methods of execution making comments when necessary. All other procedures as per the CAHPER Fitness Performance Test Manual were followed (see Appendix A for detailed instructions and equipment).

#### Reliabilities

The reliability coefficients of the CAHPER Fitness Performance Test are: sit-ups 0.861, standing broad jump 0.899, shuttle run 0.776, 50 yard dash 0.792 (Field, 1964). Klesius (1968) found reliability values of 0.57 for speed sit-ups, 0.68 for the shuttle run, 0.94 for the standing broad jump, and 0.86 for the 50 yard dash. Both Klesius and Field stated that the tests are more reliable if the correct number of trials are used. Crawford and Mason (1974) report reliabilities of 0.86 for the speed sit-ups, 0.83 for the standing broad jump, 0.71 for the flexed arm hang, 0.68 for the 50 yard run, and 0.42 for the 300 yard run. However when two runners are on parallel 300 yard run courses they report that the reliability increases to 0.82.

## Crawford and Virgin Test Items

The Crawford and Virgin test items (Appendix B) are as follows:

### Grade One

<u>Test Item</u>	<u>Measurement</u>
The Agility Run	Speed, agility, judgement of distance.
Throwing	Hand-eye coordination, ability to throw into a given area.
Stork Stand	Static balance.
Jump and Clap	Hand foot coordination, timing.

### Grade Five

Agility Run	Speed, agility, judgement of distance.
Alternate Wall Toss	Hand eye coordination, ability to use both hands to catch.
Soccer Ball Throw	Accuracy, arm strength, hand-eye coordination
Toe Touch	Agility, flexibility

The investigator used these test items on the West End children because it was the only previous test battery used in testing children from a high density area.

The Crawford and Virgin test items were not familiar to the students of Lord Roberts Elementary School and Annex and instructions were given to each participant before the test was administered. The testing was conducted in the



gymnasium with two test items being administered in each gym period. It was necessary to take three periods to complete the testing: one for the agility run and stork stand (grade 1) or the agility run and alternate wall toss (grade 5), one for the ball throw and jump and clap (grade 1) or one for the soccer ball throw and toe touch (grade 5) and one period to test those who missed a previous testing period. The investigator used students as ball chasers when balls strayed from the participant.

#### Reliabilities

It was difficult to accept that the Crawford and Virgin test items were valid tests of speed, agility, judgment of distance, hand-eye coordination, static balance, hand-foot coordination, timing, ability to use both hands, accuracy, arm strength, and flexibility. The investigator was not familiar with this test battery and could find no supporting evidence in the Crawford and Virgin report regarding background information on the test items.

The reliabilities of the test items were also difficult to find as they were not written up in Crawford and Virgin's study. However the investigator found a reliability of 0.87 for the stork stand reported by Johnson and Nelson (1969). However, the test battery was used as it was the only previous study of a similar nature.

#### The Design

The design was a 6 x 2 x 3 randomized groups design

with 10 dependent variables per subject.

#### Independent Variables:

1. Age 6 levels: 7, 8, 9, 10, 11 and 12 years. The age recorded was that of the first day of the test.
2. Sex: 2 levels - male and female.
3. Living Area: 3 levels - West End, Vancouver, and Canada.

#### Dependent Variables:

##### CAHPER Fitness Performance Test Scores

1. Sit-ups
2. Standing Broad Jump
3. Shuttle Run
4. Flexed Arm Hang
5. 50 Yard Dash
6. 300 Yard Run

##### Crawford and Virgin Test Scores

Grade 1		Grade 5	
7.	Agility Run	7.	Agility Run
8.	Throwing	8.	Alternate Wall Toss
9.	Stork Stand	9.	Soccer Ball Throw
10.	Jump and Clap	10.	Toe Touch

##### The Statistical Analysis

The data for grades two to seven on the Fitness Performance Test items was collected on the CAHPER Fitness Performance Test score cards (Appendix C) and the Motor Ability test score cards (Appendix D) were used in collecting

the data for grade 1 and grade 5 on the Crawford and Virgin test items. The test scores, age and sex were then entered on Fortran coding sheets and then punched onto the computer cards.

The data submitted for analysis were the means, standard deviations, and sample sizes of each of the 36 conditions (6 age levels by 2 sex levels by 3 area levels). The data for the Canadian sample were based on the CAHPER norms with sample size of 50 subjects per cell. Although the actual sample size was much larger than this (approximately 500), it was necessary to maintain relatively equal sample sizes across all cells for the statistical analysis. The net effect of this reduced sample size was to make the test slightly more conservative.

#### Data Analysis

The CAHPER data was analyzed by a 6 x 2 x 3 multivariate analysis of variance through the use of computer program FINN (1968). This provided multivariate F-ratios for testing the significance between mean vectors for hypotheses 1 and 2, as well as univariate and step-down F's for each dependent variable for each hypothesis. An orthogonal breakdown of the area main effect provided two independent tests:

1. West Area versus Vancouver area
2. the average of West End and Vancouver versus Canada.

As it is not possible to test hypothesis 2 independently of

hypothesis 1, these two orthogonal contrasts provided evidence for supporting or rejecting these hypotheses.

The analyses also provided the following comparisons for further data explanation:

1. sex differences
2. age differences
3. sex by area interaction
4. age by area interaction - to test if the change in performance over age (i.e. motor development) was the same for West End as for Vancouver.

## CHAPTER IV

### RESULTS AND DISCUSSIONS

#### Results

The six item CAHPER test (1966) was administered to 477 students and the four item Crawford and Virgin battery (1971) was administered to 167 students of the Lord Roberts Elementary School and Annex. The age range of the subjects tested was from 7 to 12 years on the CAHPER Fitness Performance Test and age 6 years and 10 years on the Crawford and Virgin Test Battery.

The testing was successful with some data being collected on every student attending the school. Several CAHPER score cards had only one or two pieces of information on them and were eliminated from the analysis. The boys CAHPER score cards were analysed with only 14 percent having one or two missing scores. The girls CAHPER score cards were analysed with 10 percent having missing data on one or two test items. (Refer to Appendix G for CAHPER test cell frequencies. The Crawford and Virgin score sheets were very complete with only one card missing two scores in the grade one sample and seven cards missing one score in the grade five sample. The results calculated from the data are therefore considered to be representative of the sample population tested. Refer to Appendix E for the CAHPER Fitness Performance Test raw scores and to Appendix F for the Crawford and Virgin test battery raw scores.

Tables of means are presented for the CAHPER Fitness Performance scores by test item, living area, age and sex. (Tables 2 to 7 ). These tables illustrate the results achieved by elementary school age children on the CAHPER Fitness Performance Test.

Table 2

## The One Minute Speed Sit-Up

Age	Canadian		West End		Vancouver		Group	
	Male	Female	Male	Female	Male	Female	Male $\bar{X}$	Female $\bar{X}$
7	20	17	22.5	19.8	25.1	28.3	22.5	21.7
8	24	19	21.8	19.2	30.8	28.6	23.9	22.4
9	26	20	29.2	26.0	36.5	31.0	30.6	25.1
10	27	22	32.4	28.1	34.2	35.0	31.2	28.4
11	29	25	33.7	29.5	44.4	35.0	35.7	29.8
12	30	22	34.3	25.3	45.1	40.6	36.5	29.3
$\bar{X}$	26	21	28.9	24.6	36.0	33.0	30.0	26.1

Table 3

## The Standing Broad Jump

Age	Canadian		West End		Vancouver		Group	
	Male	Female	Male	Female	Male	Female	Male $\bar{X}$	Female $\bar{X}$
7	3.75	3.50	3.40	2.97	3.80	4.02	3.65	3.50
8	3.92	3.83	3.56	3.20	4.37	4.08	3.95	3.70
9	4.33	4.00	4.06	3.61	4.90	4.68	4.43	4.10
10	4.50	4.25	4.20	3.97	4.86	4.98	4.52	4.40
11	4.83	4.58	4.28	4.20	5.57	5.15	4.89	4.64
12	5.00	4.66	4.64	4.06	5.99	5.80	5.21	4.84
$\bar{X}$	4.39	4.14	4.02	3.67	4.92	4.79	4.44	4.20

Table 4

## The Shuttle Run

Age	Canadian		West End		Vancouver		Group	
	Male	Female	Male	Female	Male	Female	Male $\bar{X}$	Female $\bar{X}$
7	14.0	14.7	13.87	15.00	13.48	13.74	13.78	14.48
8	13.3	14.0	13.42	14.39	13.12	13.47	13.28	13.95
9	12.7	13.5	12.32	13.76	12.39	13.00	12.47	13.42
10	12.6	13.0	12.37	13.49	12.58	12.28	12.52	12.92
11	12.2	12.8	12.54	12.86	11.92	12.65	12.22	12.77
12	12.0	12.8	12.51	12.52	11.45	12.36	11.98	12.56
$\bar{X}$	12.8	13.5	12.84	13.67	12.49	12.92	12.70	13.35

Table 5

## The Flexed Arm Hang

Age	Canadian		West End		Vancouver		Group	
	Male	Female	Male	Female	Male	Female	Male $\bar{X}$	Female $\bar{X}$
7	18	11	17.12	11.35	23.57	18.46	19.56	13.60
8	23	13	17.92	14.44	28.85	20.90	23.26	16.11
9	27	14	30.04	17.60	38.16	25.65	31.73	19.08
10	27	17	32.67	23.43	28.87	21.30	29.51	20.58
11	31	16	35.46	25.21	37.47	22.35	34.64	21.19
12	35	14	39.21	27.31	42.19	29.92	38.80	23.74
$\bar{X}$	27	14	28.74	19.89	33.19	23.10	29.58	19.05

Table 6

## The 50 Yard Run

Age	Canadian		West End		Vancouver		Group	
	Male	Female	Male	Female	Male	Female	Male $\bar{X}$	Female $\bar{X}$
7	10.0	10.5	9.88	10.49	9.67	10.47	9.85	10.49
8	9.5	9.9	9.57	9.89	9.52	9.96	9.53	9.92
9	9.1	9.5	9.17	9.71	8.92	9.34	9.06	9.52
10	8.8	9.0	8.93	9.42	8.72	8.95	8.82	9.12
11	8.4	8.7	8.77	9.00	7.82	8.78	8.33	8.83
12	8.3	8.5	8.76	8.95	7.91	8.11	8.32	8.52
$\bar{X}$	9.0	9.4	9.18	9.58	8.76	9.27	8.99	9.40

Table 7

## The 300 Yard Run

Age	Canadian		West End		Vancouver		Group	
	Male	Female	Male	Female	Male	Female	Male $\bar{X}$	Female $\bar{X}$
7	84	85	84.79	88.18	75.78	71.45	81.52	81.54
8	78	80	79.70	84.53	72.82	71.38	76.84	78.64
9	75	77	78.59	81.84	65.86	70.37	73.15	76.40
10	72	75	74.68	77.55	68.42	69.47	71.70	74.00
11	70	72	71.97	75.60	61.99	67.51	67.99	71.70
12	67	71	72.45	75.57	61.89	64.16	67.11	70.24
$\bar{X}$	74	77	77.03	80.55	67.79	69.06	73.05	75.40

Corresponding figures to the above tables follow.

Tables of means are presented for the Crawford and Virgin test battery items by grade, living area, test item and sex (Tables 8 & 9 ). These tables illustrate the results achieved by North York and West End children on the Crawford and Virgin test battery.



Figure 1  
Combined Male and Female  
Sit Ups

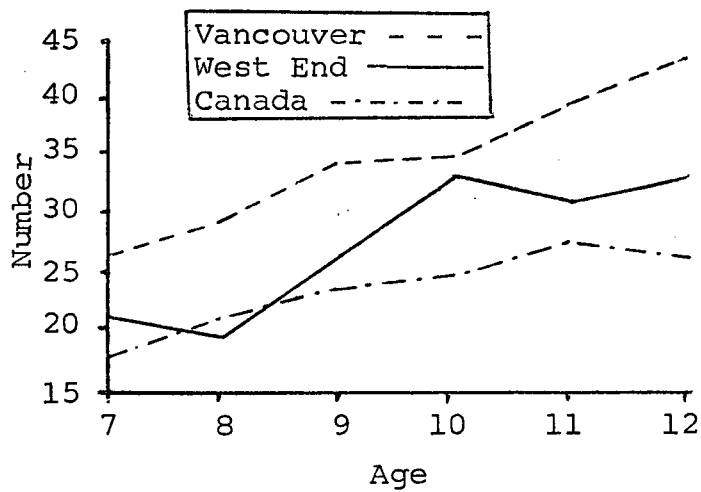


Figure 2  
Combined Male and Female  
Broad Jump

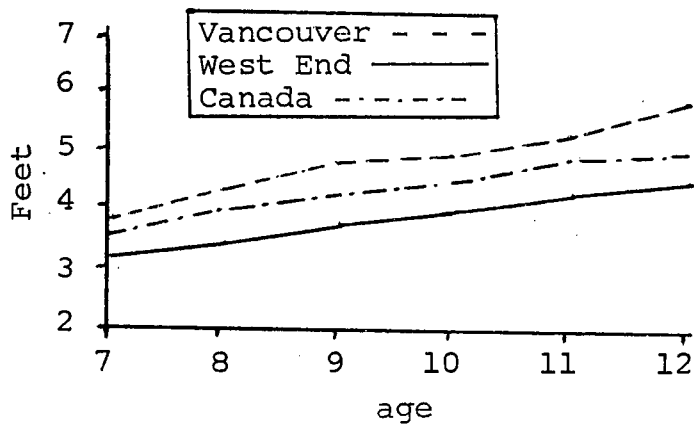


Figure 3  
Sit Ups - Female

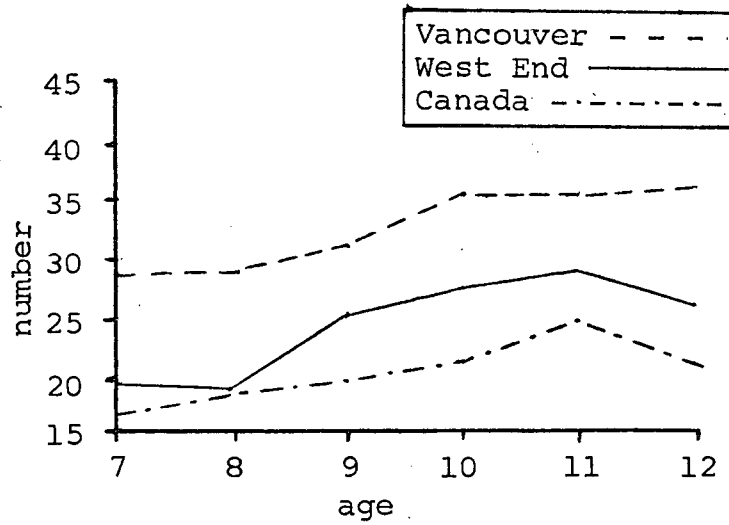


Figure 4  
Sit Ups - Male

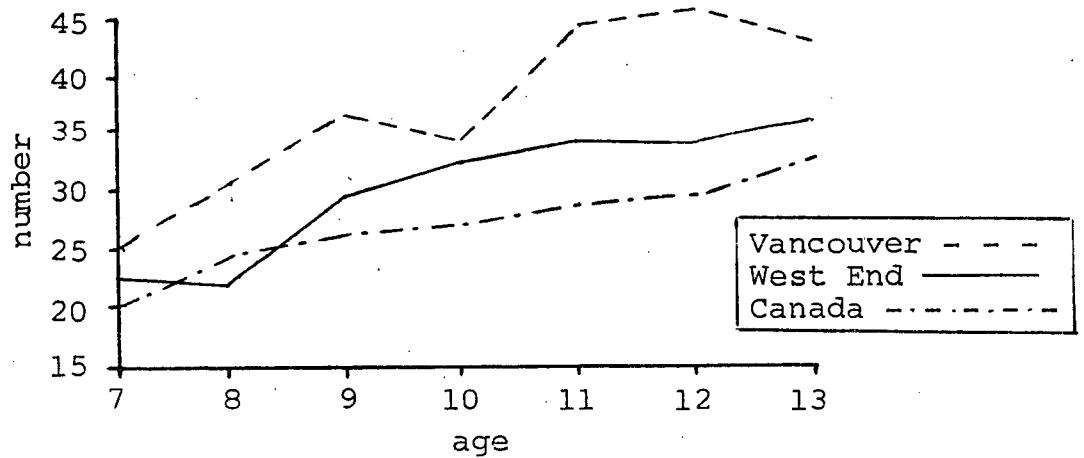


Figure 5  
Broad Jump - Female

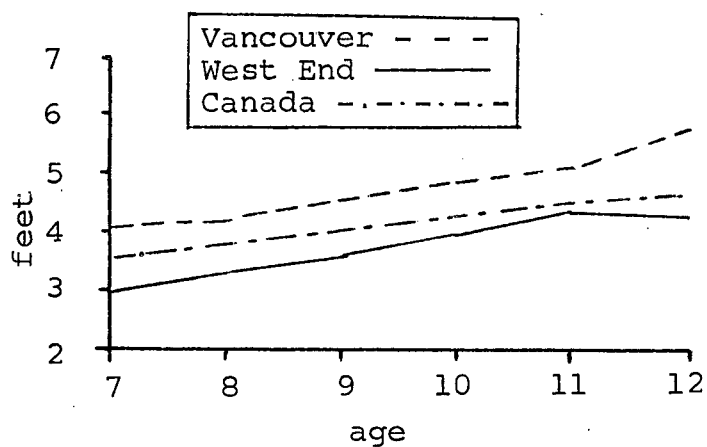


Figure 6  
Broad Jump - Male

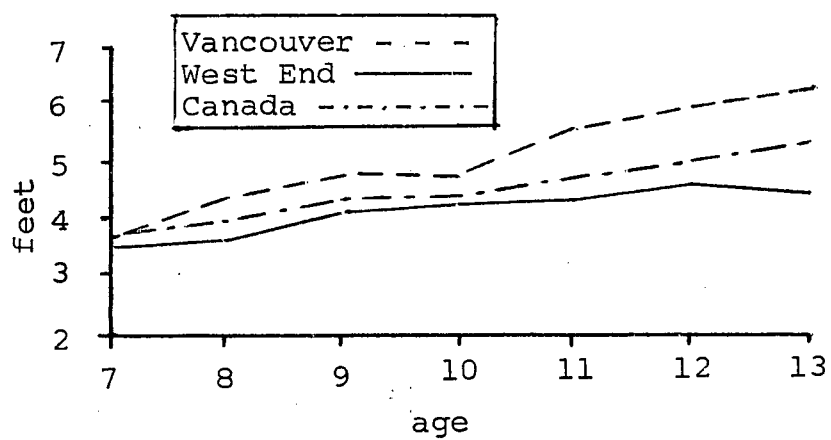


Figure 7  
Combined Male and Female  
Shuttle Run

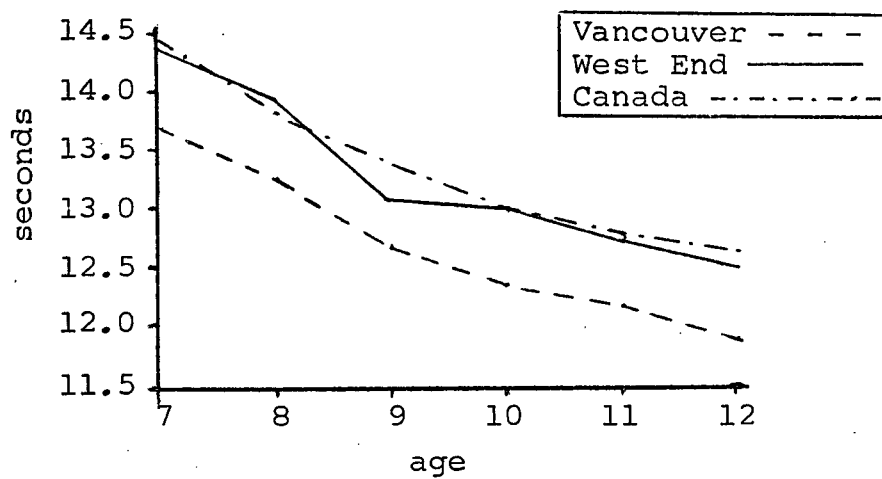


Figure 8  
Combined Male and Female  
Flexed Arm Hang

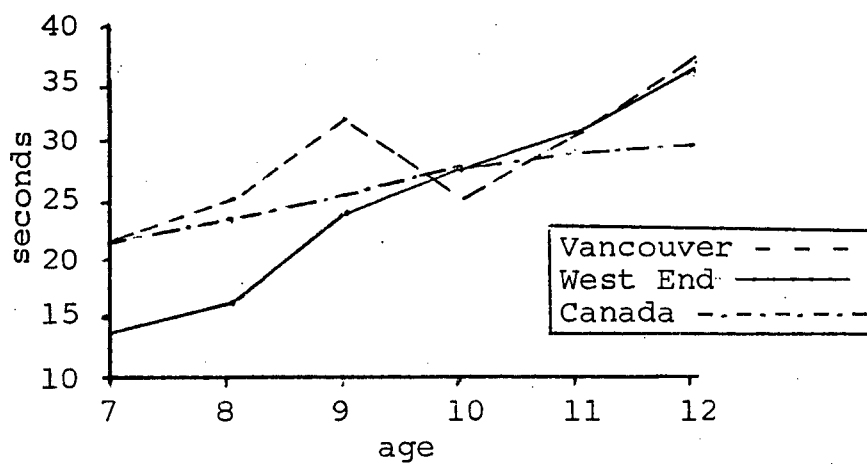


Figure 9  
Shuttle Run - Female

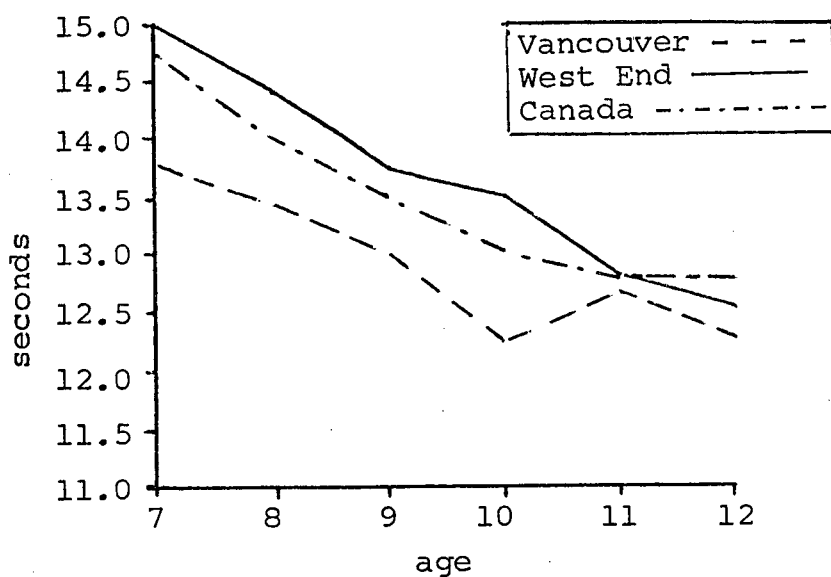


Figure 10  
Shuttle Run - Male

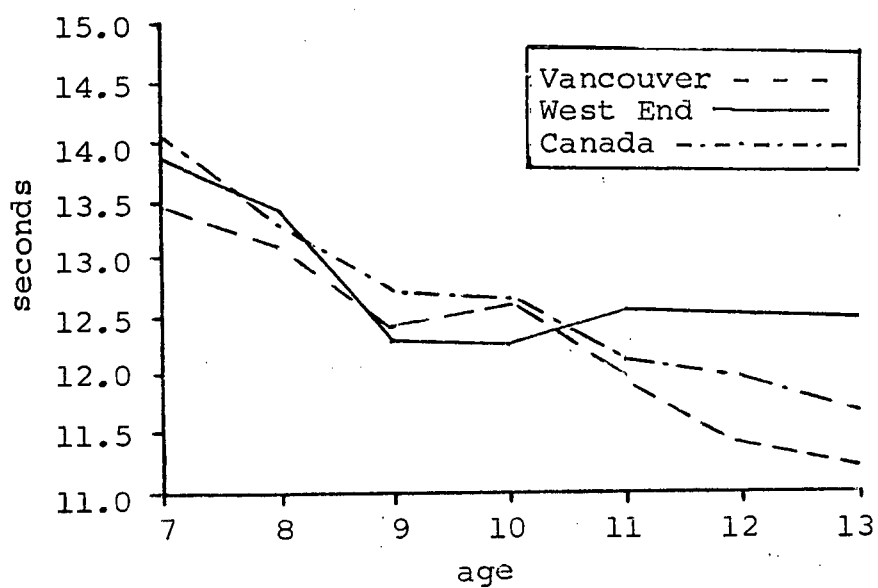


Figure 11  
Flexed Arm Hang - Female

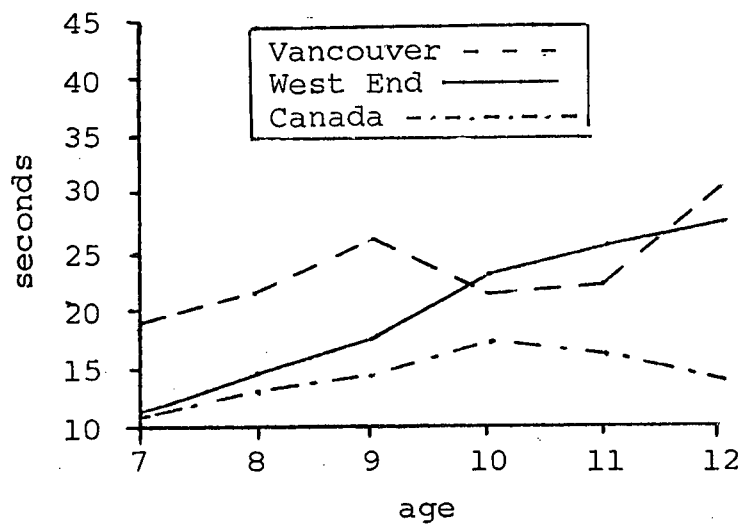


Figure 12  
Flexed Arm Hang - Male

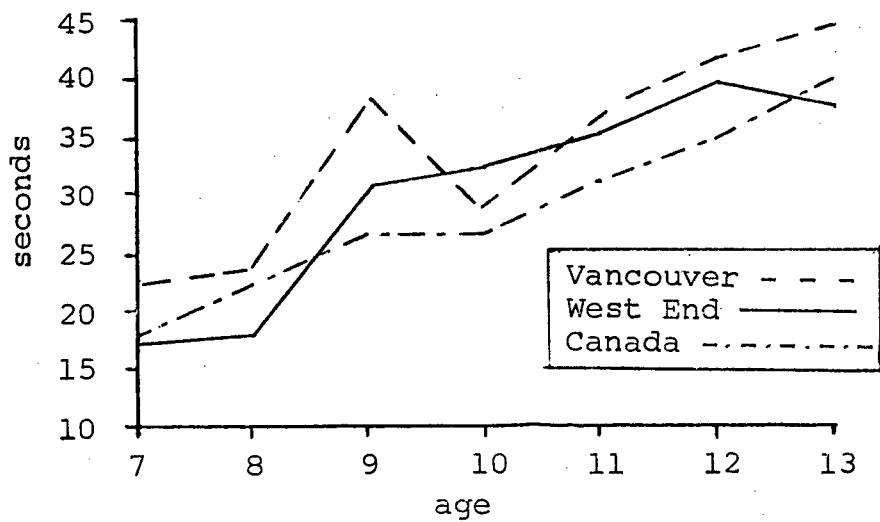


Figure 13  
Combined Vancouver, West End and Canada  
Shuttle Run

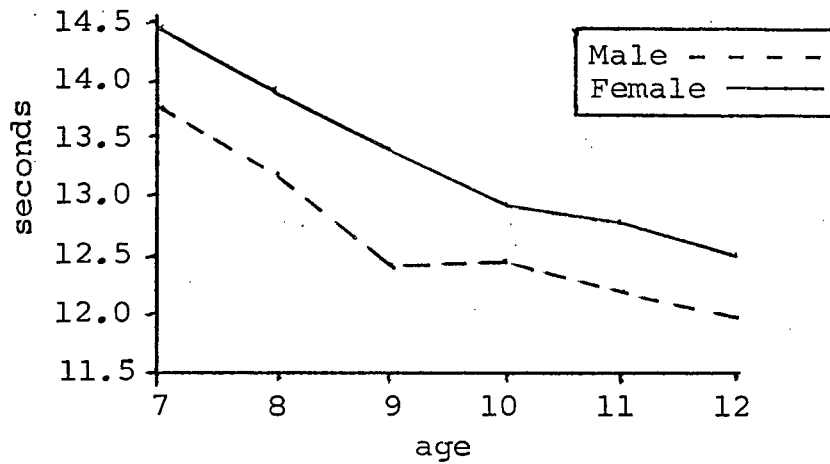


Figure 14  
Combined Vancouver, West End and Canada  
Flexed Arm Hang

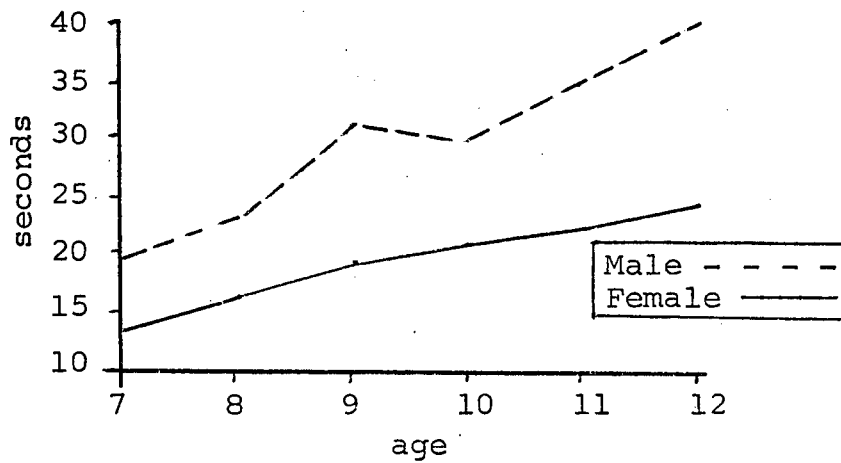


Figure 15  
Combined Male and Female  
50 Yard Run

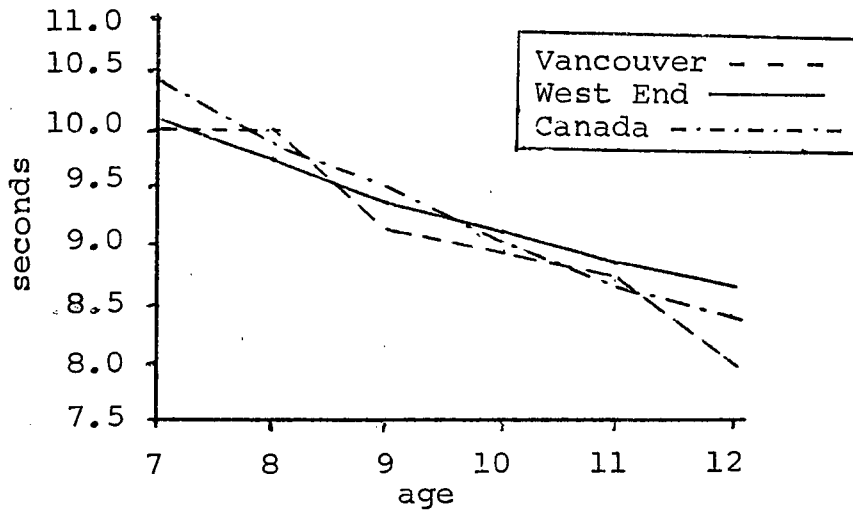


Figure 16  
Combined Male and Female  
300 Yard Run

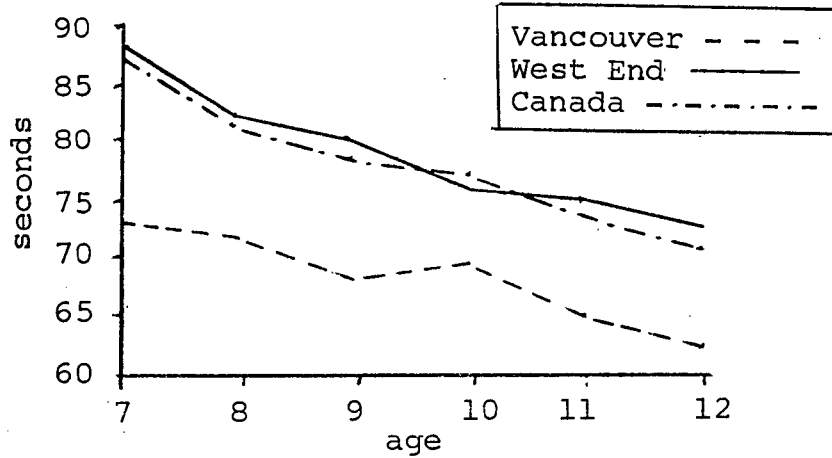




Figure 17

50 Yard Run - Female

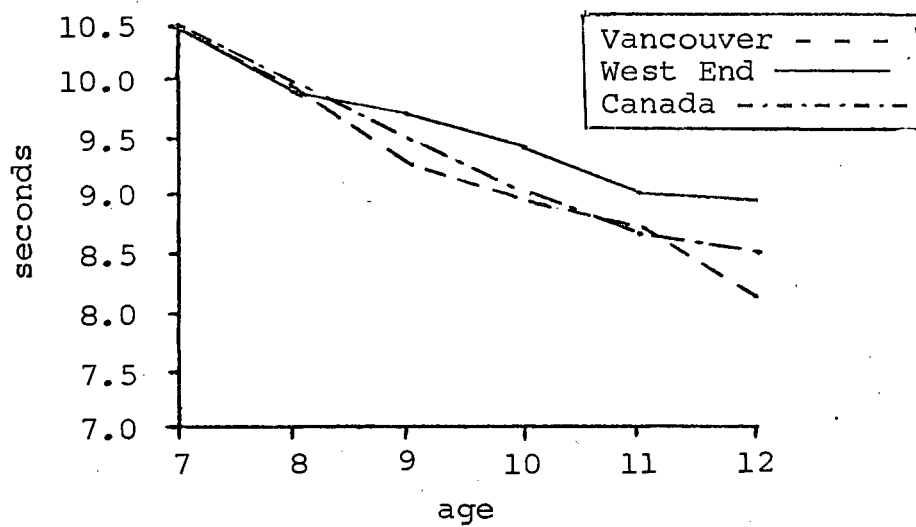


Figure 18

50 Yard Run - Male

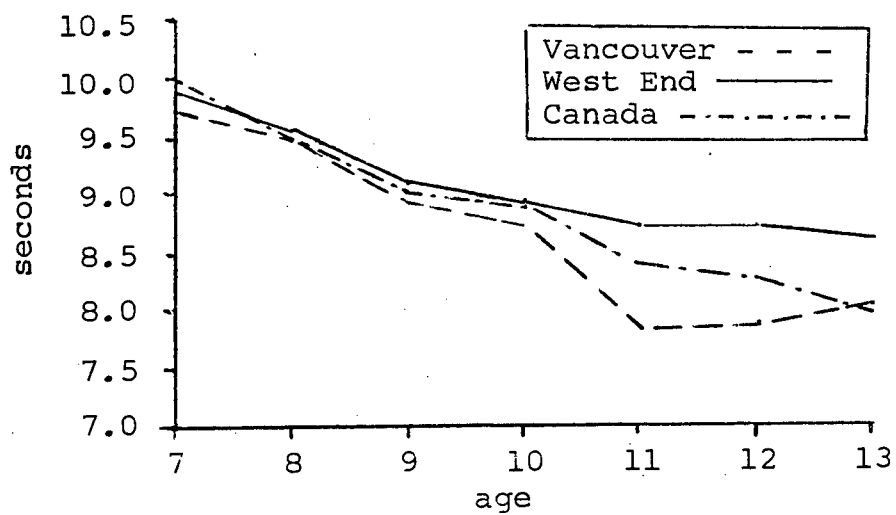


Figure 19  
300 Yard Run - Female

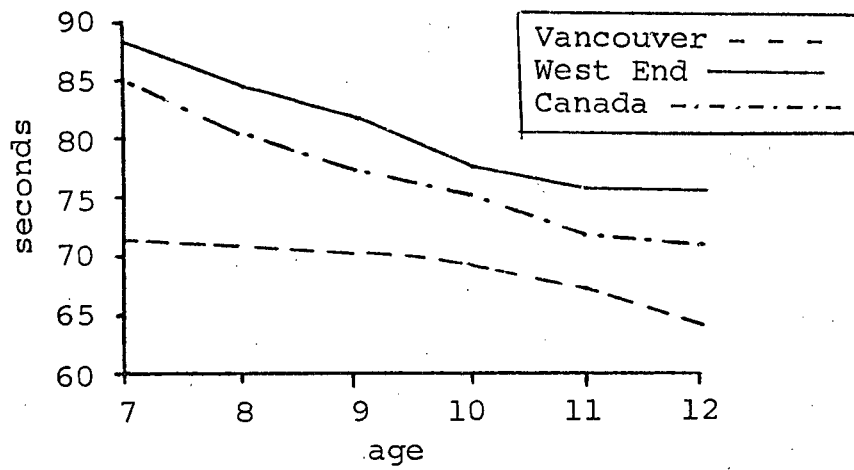


Figure 20  
300 Yard Run - Male

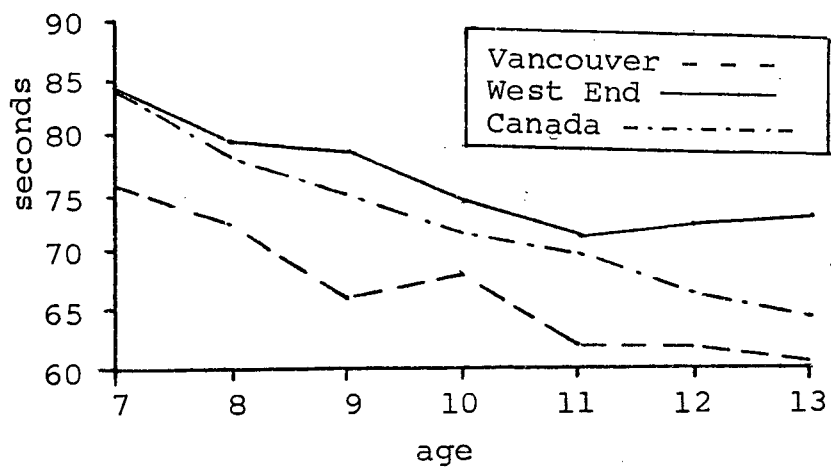


Figure 21  
Combined Vancouver, West End and Canada  
50 Yard Run



Figure 22  
Combined Vancouver, West End and Canada  
300 Yard Run

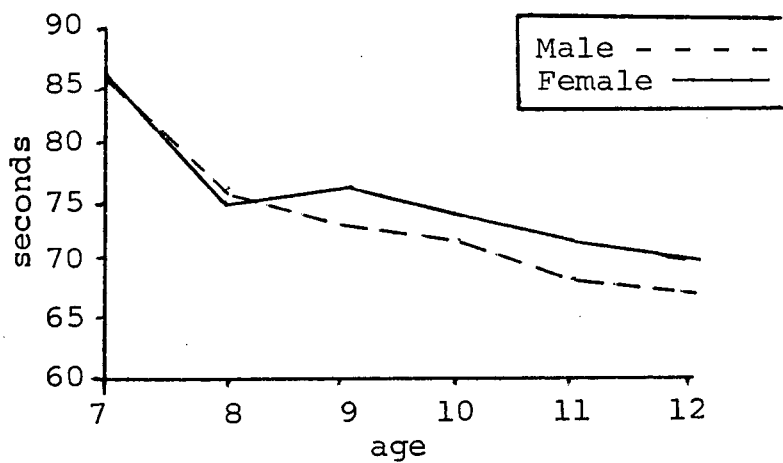


Table 8

## Crawford and Virgin Table of Means

## Grade 1

	West End		North York Single Family		North York High Rise	
	Male	Female	Male	Female	Male	Female
Agility Run	9.84	9.69	8.6	9.0	9.2	9.3
Throwing	5.20	4.09	7.5	5.7	7.7	5.4
Stork Stand	12.15	10.80	11.0	11.9	6.8	9.5
Jump and Clap	11.51	15.58	14.4	17.6	15.7	21.3

Table 9

## Crawford and Virgin Table of Means

## Grade 5

	West End		North York Single Family		North York High Rise	
	Male	Female	Male	Female	Male	Female
Agility Run	7.48	7.99	9.0	9.5	9.25	9.75
Alternate Wall Toss	8.28	4.03	10.2	9.6	8.00	9.30
Soccer Ball Throw	4.24	4.31	4.2	2.5	4.00	2.00
Toe Touch	3.00	2.53	*	*	*	*

\* Missing Data

Table 10

Multivariate and Univariate F Ratios  
for all Comparisons

Comparisons	1	2	3	4
	West End vs Vancouver	West End & Vancouver vs Canada	West End vs Vancouver x age <sub>linear</sub>	West End vs Vancouver x sex
<hr/>				
Multivariate				
F	105.6	42.9	10.1	3.5
p	< 0.0001	0.0001	<0.0001	0.0019
Situps				
F	91.2	133.8	5.8	0.65
p	0.0001	0.0001	0.016	0.4209
Broad Jump				
F	236.1	1.3	11.2	3.4
p	0.0001	0.2377	0.0009	0.0664
Shuttle Run				
F	37.5	26.2	0.04	6.6
p	0.0001	0.0001	0.8406	0.0101
Flexed Arm Hang				
F	10.3	0.35	3.8	0.06
p	0.0014	0.5548	0.0509	0.8118
50 Yard Run				
F	23.9	8.9	15.9	0.6
p	0.0001	0.0030	0.0001	0.4331
300 Yard Run				
F	385.1	91.8	1.3	5.0
p	0.0001	0.0001	0.2471	0.0262
<hr/>				

Hypothesis I states that children from the West End score lower than children from Vancouver on the CAHPER Fitness Performance test. As seen on table 10 for items of the CAHPER Fitness Performance Test there was a significant difference between West End and Vancouver CAHPER Fitness Performance test scores ( $P < 0.01$  which is shown graphically in figures 1, 2, 9, 10, 17, 18). To further examine the nature of the differences comparisons three and four of table 10 were examined. Comparison three which looks at the linear change over age reveals that for all variables except the broad jump and 50 yard dash the linear trend over age is the same for the West End children as it is for the Vancouver children.

In the broad jump the difference between the West End and the Vancouver seven year olds was 0.72 feet whereas the difference between the West End and the Vancouver twelve year olds was over twice that at 1.55 feet (table 3, figure 2). In the 50 yard dash the difference between the West End and the Vancouver seven year olds was 0.12 of a second whereas the difference between the West End and the Vancouver twelve year olds was 0.85 of a second (table 6, figure 17).

Comparison four, West End Vancouver times sex interaction, shows that the difference between West End and Vancouver children was constant for males and females on all variables except the shuttle run and the 300 yard run. In the shuttle run the difference between the West End and the Vancouver males was 0.4 of a second in comparison to the difference between the West End and the Vancouver females

Table 11  
Crawford and Virgin Tests by Floor Level  
Grade 1

		Floors 0 - 3		Floors 4 - 20	
		Male	Female	Male	Female
Agility Run	$\bar{X}$	9.4	9.9	10.1	9.7
	N	16	11	32	21
Throwing	$\bar{X}$	5.2	2.9	5.0	4.7
	N	13	10	31	21
Stork Stand	$\bar{X}$	10.8	9.8	12.2	9.8
	N	16	11	32	19
Jump & Clap	$\bar{X}$	14.1	13.7	10.1	17.7
	N	16	11	32	19

Table 12  
Crawford and Virgin Tests by Floor Level  
Grade 5

		Floors 0 - 3		Floors 4 - 20	
		Male	Female	Male	Female
Agility Run	$\bar{X}$	7.5	7.5	7.4	7.7
	N	15	17	10	15
Alternate Wall Toss	$\bar{X}$	6.9	3.3	11.9	4.9
	N	15	12	10	13
Soccer Ball Throw	$\bar{X}$	4.0	3.9	5.6	4.6
	N	15	17	10	15
Toe Touch	$\bar{X}$	4.7	2.3	4.5	2.5
	N	10	16	10	15

Table 13

## CAHPER Fitness Performance Test by Floor Level

Age 7

		Floors 0 - 3		Floors 4 - 20	
		Male	Female	Male	Female
Sit Ups	$\bar{X}$	18	22	23	16
	N	12	11	19	21
Shuttle Run	$\bar{X}$	13.5	14.9	14.1	14.9
	N	11	11	18	18
50 Yard Run	$\bar{X}$	9.8	10.4	9.9	10.6
	N	8	9	17	17
300 Yard Run	$\bar{X}$	83.3	88.4	87.2	93.5
	N	8	8	15	18

Table 14

## CAHPER Fitness Performance Test by Floor Level

Age 10

		Floors 0 - 3		Floors 4 - 20	
		Male	Female	Male	Female
Sit Ups	$\bar{X}$	39	27	33	27
	N	10	17	10	11
Shuttle Run	$\bar{X}$	12.3	13.8	12.3	13.7
	N	10	17	10	14
50 Yard Run	$\bar{X}$	9.0	9.3	8.9	9.5
	N	10	15	10	13
300 Yard Run	$\bar{X}$	72.2	82.6	74.5	83.9
	N	10	14	10	12



0.8 of a second (table 4, figures 11, 12). On the 300 yard run the difference between the West End and the Vancouver males was 9.2 seconds and the difference between the West End and the Vancouver females was 11.5 seconds.

Hypothesis 2 states that the children from the West End score lower than the children from Canada on the CAHPER Fitness Performance Test. This is not evident from the data available. There is a trend towards lower scores by West End children but the difference is not great as seen in tables 2 to 7 and figures 1, 2, 9, 10, 17 and 18.

Hypothesis 3 states that the children from apartment floors four to twenty score lower than the children living below the fourth floor on the CAHPER Fitness Performance Test. This is not apparent from the data as there were very few differences between the scores achieved by children living below the fourth floor and the scores achieved by children living on and above the fourth floor on both the CAHPER Fitness Performance test and the Crawford and Virgin tests (tables 11, 12, 13, 14).

Hypothesis 4 states that there is no difference between the motor performance scores of the children from the West End and the motor performance scores of the children from North York. This is evident as can be seen in tables 8 and 9.

## Discussion

The children living in the West End scored significantly lower on the CAHPER test than the children from Vancouver

(table 10). This supports hypothesis I which states the scores of the children from the West End are lower than the Vancouver scores on the CAHPER Fitness Performance test. There are many contributing factors which would directly influence the scores on the CAHPER Fitness Performance test such as socio-economic background, opportunity for participation, attitudes held by parents towards physical activity, practice of the test items, and the play environment. It is contended in this study that it is primarily the opportunity for participation and the play environment which was been the major contributors influencing the lower scores by West End elementary school age children on the CAHPER Fitness Performance test.

The children living in the West End have access to only one park within the West End besides the barren elementary school playground. This fact reveals that children in the West End wishing to play out of the way of traffic and with suitable play space must go to Nelson Park or one of the two school grounds. It can be seen that for a population of 1100 children the play facilities are totally inadequate. Stanley Park surrounds two sides of the West End and offers space, safety and adequate play facilities. However, access to Stanley Park is difficult for young children because of the traffic and the Park is felt an unsafe environment for older children because of the other individuals of questionable character and morals. The Park is only minutes from downtown Vancouver; a port city not without its undesirable

elements. Therefore children living in the West End really have only one park and two school grounds within safe distance from their residence. Considering the elementary school population is approximately 700, the facilities appear totally inadequate.

Comparison three, table 10, revealed that the linear change over age was the same for West End and Vancouver children for all variables except the broad jump and the 50 yard dash. The finding that the West End children did not improve at the same rate as the Vancouver children in the broad jump which is a measure of leg muscle power indicates that as the children of the West End aged their performance decreased relative to the Vancouver children. The broad jump test results alone would indicate that as children living in the West End age the development of their leg power is retarded relative to the other test items where the linear relationship was held. However the 50 yard dash scores also follow a similar trend. The 50 yard dash difference between the seven year olds was 0.12 of a second whereas the difference between the twelve year olds was 0.85 of a second (table 6, figure 17). The 50 yard dash is a test of leg muscle power and speed. This would indicate that children in the West End fall behind in leg power and speed between the ages of seven and twelve. Taking into consideration the children from the West End, the living environment and all its influences, the type of families living in the West End, and programs the children are involved in, the investigator feels the lower

scores in the leg power and speed items are due to the lack of opportunity to participate in activities which develop these aspects of fitness.

Comparison four, table 10, which looks at West End - Vancouver by sex interaction showed that the difference between the West End and Vancouver children was constant for boys and girls on all variables except the shuttle run and the 300 yard run. This difference shows that the girls in the West End did not develop in their agility and cardiovascular endurance to the same degree as the boys from the West End relative to the Vancouver boys and girls. The reasons for the girls being retarded in their development on the agility and 300 yard run test items are difficult to determine. It is felt by the investigator that agility and cardiovascular endurance are more specialized aspects of fitness and can be improved by participation in activities which lend themselves to the development of these fitness qualities more than practice of power, speed, abdominal strength, and arm strength. This is not to say that practice of activities to improve the latter fitness qualities will have no effect but rather that agility and cardiovascular endurance activities require more participation to improve ones performance. The girls of the West End, it would appear, spend less time participating in activities which develop agility and cardiovascular endurance than the girls of Vancouver whereas the boys show no significant change in participation habits. It is not possible to determine why this is so from this study

except to suggest that boys are involved in more out of doors activity where agility and cardiovascular endurance are required.

The children living in the West End scored the same as the Canadian normative data on the CAHPER Fitness Performance test. This is an interesting finding which means that the average child living in the West End is as fit as the average Canadian child. Several explanations the investigator can make to support this finding are as follows. One, to indicate that even though the children live in a restricted environment the fact that they can play at summer activities all year round in Vancouver has enabled them to score on a par with the Canadian norms. Further, the children from the West End had had some exposure to the test items previous to the results being collected whereas the Canadian data came from the childrens first exposure to the test items. Also the Canadian data is six years older than the West End data and should be expected to be lower.

It was felt by this investigator that children living higher up in a building would score lower on fitness and motor skill activities than children living closer to the ground. There would be several reasons for this. Apartments with more than three stories must provide an elevator and therefore in these buildings the children would tend to use the elevator rather than walk up to their suites especially if they lived above the third floor. Lower buildings tend to have only three stories and provide no elevators which would mean the children would use the stairs because of necessity and derive a high level of activity from the use of the stairs.

Also the proximity to the ground should be an asset in getting the children out to play.

This was not the case as there was no difference shown between floor levels 0 to 3 and 4 to 20 on the CAHPER Fitness Performance test and the Crawford and Virgin test items.

On the Crawford and Virgin test items there was little evidence of difference between the West End scores and North York scores. This was anticipated because of the similar housing the children were drawn from.

## CHAPTER V

### SUMMARY AND CONCLUSIONS

#### Summary

This study looked at the fitness and motor performance of children living in a high density area and compared their test scores to test scores recorded on children of the same age living in a low density area. This was done to investigate the influences of high density living on elementary school aged children's fitness and motor performance.

The elementary school population of the Vancouver West End district was selected to be tested on motor performance and physical fitness test items. The CAHPER Fitness Performance Test and a battery of tests previously used by Crawford and Virgin in North York Ontario were used in the testing. The scores recorded were then compared to the Vancouver CAHPER norms, the Canadian CAHPER norms and the test scores recorded by Crawford and Virgin in their North York study. The results indicated that West End children score lower than Vancouver children and there are definite disadvantages to living in the Vancouver West End District; the play space for children is limited and the scores recorded on several test items are significantly below the Vancouver norms.

## Conclusions

The conclusions which can be formed from the findings of this study are:

1. West End Elementary school age children score lower than Vancouver elementary school age children on the CAHPER Fitness Performance test. This agrees with Hird's finding of lower physical activity by flat dwellers (Hird, 1966, Darke and Darke, 1970).
2. The children living in the West End fall behind their peers in Vancouver in leg power and speed between the ages of seven and twelve.
3. The girls from the West End do not develop in their agility and cardiovascular endurance at a normal rate.
4. There was no difference between the scores of the children living on floors 1-3 and the scores achieved by children living on floors 4-20.
5. The CAHPER Fitness Performance scores improve as a child grows older at least to the age of twelve.
6. Males score higher than females on the CAHPER Fitness Performance test at the same age level.

## Suggestions

The investigator would like to recommend further inquiry into this field of study. This further inquiry should be of a more pure research nature with smaller groups of children. It is quite evident that the West End children are lacking in fitness performance when compared to their



peers in greater Vancouver and inquiry should try to focus in on the cause. It is recommended that several other cities with similar housing conditions be included in such studies.

Secondly, programs should be developed to improve the present state of fitness of these children through the addition of a) a physical education specialist and b) increased quantity of true physical education time in the gym for children in grades one on up.

Thirdly and finally the investigator would recommend to the City of Vancouver that they move forward with their new concepts and plans to make the West End a more livable environment.

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## APPENDICES

## APPENDIX A

## DESCRIPTION OF THE CAHPER FITNESS-PERFORMANCE TEST

The One Minute Speed Sit-Ups

Equipment: Gym mat and stop-watch or timer.

Start: The subject assumes a back-lying position on the mat, fingers interlaced behind his head. The knees are bent and the feet are held flat on the floor by a partner.

Performance: The subject sits up and touches both elbows to his knees. Then he returns to the starting position.

Scoring: The movement sit-up and return is counted as one execution. The total score is the number of complete executions performed in 60 seconds. Count when the elbows touch the knees. Allow one trial.

Controls: The partner kneels straddling the performer's feet. He places his hands on the calves of the subject's legs just below the back of the knee to prevent the subject from sliding and to maintain the starting position of the legs throughout the test. Only the shoulders have to touch the floor. The sit-ups do not need to be performed continuously.

The Standing Broad Jump

Equipment: A 10 foot tumbling mat is recommended and a cloth tape measure.

Start: The subject assumes a position with the feet slightly apart and the toes behind the take-off line.

Performance: The hips, knees and ankles should be bent enough so that the subject can vigorously push with his legs, and swing his arms to jump as far forward as possible.

Scoring: Measurement is in terms of inches to the nearest inch from the take-off line to the heel of the foot nearest the take-off line.

**Controls:** The suggested take-off angle should be between 30 and 45 degrees. Two valid trials are allowed, the better trial recorded. If any part of the body touches behind the heels, the jump will be considered invalid. Two or three practice trials will be allowed.

### The Shuttle Run

**Equipment:** Two wooden blocks (2" x 3" x 3") and a stop-watch calibrated to one-tenth of a second.

**Start:** The subject lies face down, hands at the side of the chest and the forehead on the starting line.

**Performance:** On the signal, the subject jumps to his feet and runs 30 feet to the line. He picks up one block of wood, returns to the starting line, and places the block behind this line. He returns to the initial line, picks up the second block of wood, and runs back across the finish line.

**Scoring:** Measurement is in terms of seconds to the nearest tenth of a second from the starting signal until the subject's chest crosses the finish line.

**Controls:** The test should be taken in gym shoes or bare-foot. A 'ready' warning signal is given prior to the starting signal. Two trials with sufficient rest between are allowed and the better trial is recorded.

### The Flexed Arm Hang

**Equipment:** A doorway gym bar or horizontal bar placed 6 feet from the floor; a bench and a timer or stop-watch.

**Start:** The subject takes a reverse grasp on the bar (palms towards face). He is assisted to the position on the bar so that his eyes are at the level of the bar. The arms are fully bent.

**Performance:** The subject holds himself in this hanging position as long as he is able.

**Scoring:** The total period of time that the subject can maintain the exact position is determined to the nearest second.



Controls: The subject must keep the eyes at the level of the bar. When the subject's head drops below the bar, the test is terminated. One trial is allowed. The tester counts the seconds out loud.

### The 50 Yard Run

Equipment: A 50 yard straightaway with markers to stakes placed at the start and the finish line; a stop-watch calibrated to one-tenth of a second and a starting flag.

Start: A racing crouch start or a standing position may be assumed.

Performance: On the starting signal 'ready', 'go', the starter drops the flag and the runner sprints the 50 yard distance as fast as he can.

Scoring: The elapsed time from the starting signal to the passage of the runner's chest across the finish line is scored to the nearest tenth of a second.

Controls: The test is taken in gym shoes. Only one runner is tested at a time on a course, but one tester may time two runners on adjacent courses with a split timer or two stop-watches.

### The 300 Yard Run

Equipment: A 50 yard straightaway with markers or stakes placed at the start and the finish line, a stop-watch and a starting flag.

Start: A racing crouch start or a standing position may be assumed.

Performance: On the starting signal the subject runs straight up and around the stake marker and back over the 50 yard straightaway. The circuit is run 3 times to make up the 300 yards.

Scoring: The elapsed time from the starting signal to the passage of the runner's chest across the finish line is scored to the nearest second.

Controls: The test is taken in gym shoes. Only one runner is tested at a time on a course, but one tester may time two runners on adjacent courses with a split timer or two stop watches.

## APPENDIX B

## CRAWFORD AND VIRGIN TEST

Grade 1Agility Run

This test is set up to test speed, agility and judgment of distance. Four cone markers are set at the following distances from a starting line: 10', 9½', 7', 6'. Each pupil is given the following instructions:

'Stand behind the starting line and face the markers. Weave around each marker going up and back; cross the finish line going as fast as you can. Make sure that you don't hit any of the markers. Ready! Go.'

The score recorded is the time in seconds to the nearest tenth of a second from the signal "Go" until the pupil crosses the finish line. If a pupil hits a cone, one second is added to his score; if a cone is knocked over, two seconds are added to the score. Each pupil is permitted two trials, with the fastest time taken as his score for this test.

Throwing

This test is designed to assess hand-eye co-ordination and ability to throw into a given area. A line is drawn parallel to the wall at a distance of eight feet. A large hula hoop is attached to the wall so that its lowest point is four feet from the floor. The following instructions are given to each pupil:

'Stand behind the white line and see how many times you can throw the bean bag into the center of the target. You have ten tries. Take your time!'

The tester hands the pupil one bean bag at a time. The score recorded is the number of successful throws out of ten tries. Hitting the rim is not counted as a 'successful' throw.

Stork Stand

This is a test for 'static' balance. Each pupil is given the following instructions:

'Leave your right foot on the ground and place the bottom of your left foot on the inside of the right knee (if the students don't know right from left, the tester touches the appropriate foot). Close your eyes and balance in that position for as long as possible. Put your foot down. This time, stand on your left foot and put your right foot up in the same position, close your eyes, and balance in that position for as long as possible.' (Tester times length of balance).

The score recorded is the length of time in seconds to the nearest tenth of a second that the student balances, with his eyes closed, his balancing foot remains in one place on the floor and his raised foot touches the knee. The clock is started when the student has raised the leg and closed his eyes, not on a specific signal given by the tester.

Each student is given two trials with the right foot remaining on the floor and two trials with the left foot remaining on the floor, alternating feet each time. The longest balancing time on each foot is added together to give the final score for the student. A maximum of thirty seconds is set for each foot.

### Jump and Clap

This test is developed to test hand-foot co-ordination and timing. The instructions given are:

'Jump, and clap your hands each time your feet hit the ground (demonstration as well). Keep going until I tell you to stop'.

The score recorded is the length of time in seconds to the nearest tenth of a second that the pupil keeps his claps co-ordinated with his landings. The clock is started after three jumps so that the student has a chance to get orientated. The maximum time allowed is thirty seconds.

### Grade 5

#### Agility Run

This test is similar to the one described for the Grade 1 pupils, with one exception. In this instance, five as opposed to four cone markers are set up at the following distances from a starting line: 10', 9½', 5½', 4', 1'. The score is the time in seconds to the nearest tenth of a second from the signal "Go" until the pupil crosses the finish line. As in Grade 1, each pupil is allowed two trials, with the fastest time taken as his score for the test.

#### Alternate Wall Toss

This test is set up to assess hand-eye co-ordination and the ability to use both hands to catch. A line is marked parallel to the wall at a distance of seven feet. A box with four extra balls is placed to the side of the pupil's right foot. The directions given are:

'Stand behind the white line and face the wall.  
Throw the ball with your right hand and catch it with your left hand, without letting it hit the ground;  
throw with your left hand, catch with your right hand.'

(demonstration) Keep doing this until I tell you to stop. If you lose a ball, pick up one from the box to your right. Ready! Go. '

The score recorded is the number of 'successful' catches in thirty seconds. To be a 'successful' catch, it must be thrown by the opposite hand to the hand which caught it, it must be caught before hitting the floor, and it must be caught without the use of the body as a trapping mechanism.

### Soccer Ball Throw

This test measures the accuracy, arm strength and hand-eye co-ordination of the pupil. A line is drawn parallel to the wall and at a distance of five feet from the wall. A rectangle (the borders are marked in red) is drawn on the wall five feet from the floor and with sides measuring 9" by 12". The instructions given to each pupil are:

'Sit down with your legs straight out, and heels on the white line. Make sure you are straight in front of the target. You have ten tries. Take your time and see how many times you can throw the ball over-hand into the center of the target.'

A red utility ball is used.

The score recorded is the number of times out of the ten trials that the student throws the ball so it lands inside the target area.

### Toe Touch

This test is designed to assess agility and flexibility. A mat is required for landing. The instructions given to each pupil are:

'Jump up and touch your toes keeping your legs straight. (A demonstration is given as well). You have five tries. Take your time.'

The score recorded is the number of times that the student completes the action touching both his toes and not bending his knees to more than 45 degrees.

## APPENDIX C

# CAHPER FITNESS PERFORMANCE TEST CARD

DEPARTMENT OF NATIONAL HEALTH AND WELFARE  
MINISTÈRE DE LA SANTÉ NATIONALE ET DU BIEN-ÊTRE SOCIAL

CANADA FITNESS AWARD—LE PRIX CANADIEN D'EFFICIENCE PHYSIQUE  
GOVERNMENT OF CANADA • GOUVERNEMENT DU CANADA



TEST RECORD  
FICHE des RÉSULTATS

[illegible]

NAME OF INSTITUTION (Please Print—En lettres moulées)			NOM DE L'INSTITUTION		
ADDRESS (Number & street; P.O. Box or R.R. No.)			ADRESSE (No et rue; Case postale ou No de R.R.)		
(City, Ville)		(Zone—Zone postale)		(Province)	

NAME OF PARTICIPANT—NOM DU PARTICIPANT									
DATE OF BIRTH DATE DE NAISSANCE			SEX—SEXE (✓)		AGE AS OF TEST DATE AGE LE JOUR DU TEST				
Day—Jour	Mth.—Mois	Yr.—Année	<input type="checkbox"/> MALE <input type="checkbox"/> HOMME	<input type="checkbox"/> FEMALE <input type="checkbox"/> FEMME					
					Years Ans				

CIRCLE THE NUMBER OF YEARS YOU HAVE PARTICIPATED (including this year)  
ENCERCLEZ LE NUMÉRO INDICANT VOS ANNÉES COMME PARTICIPANT, Y COMPRIS CETTE ANNÉE.

	1	2	3	4	5	6	7	8	9	10	11
TESTS—ÉPREUVES						RAW SCORE COMPTE BRUT	PERCENT POUR- CENTAGE		BEST %'S EXTENDED MEILLEURS % ATTEINTS		
SPEED SIT-UPS REDRESSEMENTS ASSIS	(No.) (Nombre)										
STANDING BROAD JUMP SAUT EN LONGUEUR	(Ft.-In.) (Pi.-Po.)										
SHUTTLE RUN COURSE—NAVETTE	(Sec.)										
FLEXED ARM HANG SUSPENSION À LA BARRE	(Sec.)										
50 YARD RUN COURSE DE 50 VERGES	(Sec.)										
300 YARD RUN COURSE DE 300 VERGES	(Sec.)										
TOTAL OF FOUR BEST, OR ALL SIX PERCENTAGES TOTAL DES QUATRE MEILLEURS OU DES SIX POURCENTAGES											

AVERAGE OF FOUR BEST OR ALL SIX PERCENTAGES  
MOYENNE DES QUATRE MEILLEURS OU DES SIX POURCENTAGES

▶ %

CHECK (✓) AWARD EARNED  
COCHER (✓) LE PRIX GAGNÉ

BRONZE  
  
 BRONZE

SILVER  
  
ARGENT

GOLD  
OR

EXCELLENCE  
  
 EXCELLENCE

## APPENDIX D

## MOTOR ABILITY TEST SCORE CARD

GRADES 1, 2, AND 3

Name \_\_\_\_\_ Age \_\_\_\_ Height \_\_\_\_ Weight \_\_\_\_

Agility Run: Trial #1 \_\_\_\_\_ Trial #2 \_\_\_\_\_ Score \_\_\_\_\_

Throw: Trials 1\_\_, 2\_\_, 3\_\_, 4\_\_, 5\_\_, 6\_\_, 7\_\_, 8\_\_, 9\_\_, 10\_\_  
Score \_\_\_\_\_Stork Stand: Trial #1 left\_\_ right\_\_  
#2 left\_\_ right\_\_  
Score \_\_\_\_\_

Jump and Clap: Time \_\_\_\_\_ Score \_\_\_\_\_

## MOTOR ABILITY TEST SCORE CARD

GRADES 4 AND 5

Name \_\_\_\_\_ Age \_\_\_\_ Height \_\_\_\_ Weight \_\_\_\_

Agility Run: Trial #1 \_\_\_\_\_ Trial #2 \_\_\_\_\_ Score \_\_\_\_\_

Alternate Wall Toss 30 second score \_\_\_\_\_ Score \_\_\_\_\_

Soccer ball throw Trials 1\_\_, 2\_\_, 3\_\_, 4\_\_,  
5\_\_, 6\_\_, 7\_\_, 8\_\_, 9\_\_, 10\_\_  
Score \_\_\_\_\_Toe touch trials: #1\_\_, #2\_\_, #3\_\_, #4\_\_, #5\_\_  
Score \_\_\_\_\_

## APPENDIX E

## CAHPER FITNESS PERFORMANCE TEST SCORES

GIRLS

AGE	SIT-UPS	STANDING BROAD JUMP	SHUTTLE RUN	FLEXED ARM HANG	50 YARD RUN	300 YARD RUN
6	15	34	16.1	2.1	11.4	93.0
6	0	36	14.8	7.3		
6	33	25	17.4	8.8	11.1	96.4
6	20	49	14.1	12.5	9.6	84.1
6	29	34	15.7	5.1	12.1	90.3
6	22	37	14.4	19.2	10.8	93.2
6	03	33	15.5	10.2	11.1	93.1
6	09	36	15.0	1.1	11.8	99.9
7	11	44	14.5	11.0	11.4	88.2
7	14	33	15.3	1.0		
7	31	48	14.2	6.3	10.5	88.0
7	20	55	12.5	13.1		
7	35	49	13.8	17.8		
7	19	48	13.9	7.2	10.2	83.7
7	04	32	15.4	0.0	10.8	93.0
7	12	38	14.3	7.5	11.2	93.8
7	15	44	14.0	8.7		
7	10	46	15.0	9.0	11.5	98.2
7	06	26	15.8	10.0	10.5	87.0
7	25	40	14.7	5.6	10.0	78.1
7	0	44	13.9	29.5	9.6	83.2
7	21	43	15.5	7.5	9.6	84.6
7	15	42	13.6	30.5	9.8	82.2
7	30	41	14.8	12.5		
7	23	48	13.1	6.2	9.6	79.0
7	28	51	16.2	15.1	9.3	82.3
7	12	31	16.1	21.5	11.0	99.9
7	15	51	14.5	13.5	10.5	83.5
7	13	40	14.5	18.1	9.6	95.5
7	30	42	14.7	9.7	9.7	75.0
7	49	50	15.2	28.5		
7	20	34	14.5	7.8	10.4	91.0
7	05	43		5.5	10.0	86.5
7	30	39	14.5	12.2	10.3	90.0
7	50	49	14.2	26.2	9.0	79.9
7	14	35	14.3	8.9	11.4	96.1
7	13	38	14.3	15.3	10.4	89.2
7	25	49	16.2	11.3	10.0	92.2
7	15	45	14.1	21.3	10.2	91.1
7	20	38	15.3	9.0	11.1	93.0
7	30	43	15.0	9.5	10.0	86.8
7	05	31	17.2	2.3	11.4	92.5
7	18	38	15.1	19.2	9.8	82.1
7	7	31	17.0	1.0	11.8	99.8

## CAHPER FITNESS PERFORMANCE TEST SCORES, Continued

AGE	SIT-UPS	STANDING BROAD JUMP	SHUTTLE RUN	FLEXED ARM HANG	50 YARD RUN	300 YARD RUN
7	24	34	15.2	1.8	13.2	99.7
7	12	27		13.3	11.6	91.2
7	07	32	16.8	4.2	11.4	97.2
7	20	38	17.0	11.0		
7	28	38	17.5	0.0		
7	15	47	14.5	5.4	9.9	84.2
7	23	32		8.8		
7	19	35	15.5	7.1	10.8	80.1
7	31	43	14.6	2.6	10.5	78.0
7	20	30	16.8	5.8	10.3	86.9
8	16	36	16.8	0.0		
8	14	54	14.1	24.0	10.3	92.3
8	23	45	13.0	29.0	9.5	83.2
8	24	52	14.2	32.0	10.1	90.3
8	31	56	15.4	41.5	9.2	82.3
8	40	47	13.9			
8	21	43	14.9	4.5	10.5	91.0
8	10	34	15.2	0.0	10.2	82.6
8	19	32	14.0		10.2	
8	18	47	14.3	33.4	9.2	79.5
8	22	41	16.2	12.1	10.5	90.0
8	06	31	17.4	4.2	11.6	97.5
8	0	37	17.1	4.2	11.7	96.5
8	18	40	14.5	4.1	11.0	99.5
8	25	33	15.8	12.2		
8	30	44	13.5	7.3	9.8	80.3
8	12	44	14.6	3.2	9.5	99.9
8	12	51	12.9	6.6	9.6	85.4
8	27	43	12.4	22.7	9.1	75.3
8	14	53	12.7	12.1	9.4	78.5
8	31	46	12.8	18.2	9.3	78.5
8	10	42	14.8	1.0	9.7	85.3
8	26	47	13.9	25.3	9.4	76.4
8	23	38	15.8	11.1	9.4	83.5
8	20	41	13.6	25.7	10.0	85.6
8	23	46	13.2	14.8	9.5	76.1
8	18	41	15.5	21.2	10.2	81.3
8	01	40	15.1	1.0	9.7	99.9
8	23	50	13.3	22.0	9.5	77.1
8	30	59	12.2	9.2	8.7	73.2
8	16	38	14.7	16.8	10.8	91.5
8	04	24	17.8	7.5	10.2	83.8
8	22	52	13.8	28.5	9.6	82.5
8	23	55	11.9	15.0	9.2	77.5
8	0	37	16.0	2.8	10.8	79.2
8	08	42	14.4			
8	17	49	12.8	4.2		
8	08	34	16.3	4.2	10.7	98.9
8	18	44	15.8	5.7	10.3	84.5
8	28	42	14.5	8.5	9.5	83.0



## CAHPER FITNESS PERFORMANCE TEST SCORES, Continued

AGE	SIT-UPS	STANDING BROAD JUMP	SHUTTLE RUN	FLEXED ARM HANG	50 YARD RUN	300 YARD RUN
8	13	37	13.8	25.2	9.8	75.9
8	17	58	13.1	8.1	8.7	85.5
8	23	39	14.7	6.3		
8	30	52	12.7	36.0	9.5	76.5
8	01	38	15.0	1.0		
8	17	49	14.5	25.1	9.6	73.5
8	17	53	12.2	9.5	9.2	92.8
8	28	39	15.3	15.4	10.9	80.5
8	24	26	12.8	13.0	9.8	79.1
9	16	33	15.0	12.5	9.4	78.3
9	22	54	14.6	22.3	10.5	
9	23	49	13.8	11.5	10.4	77.8
9	25	59	12.4	17.0	9.8	75.7
9	04	49	12.5	14.2	9.4	80.4
9		38		23.0	11.0	85.0
9	24	50	12.8	17.0	9.4	86.0
9	25	38	13.8	3.0	10.4	86.2
9	30	50	12.6	15.2	8.6	67.2
9	38	55	11.8	53.0		
9	33	36	14.8	1.0	10.0	85.1
9	28	51	13.1	4.0	9.0	76.0
9	21	52	13.1	11.2		
9	21	37	15.5	1.0	11.5	99.3
9	28	45	13.1	11.5		
9	21	50	12.8	35.0	10.4	85.0
9	13	43	14.5	11.0		
9	48		13.2		8.3	
9	25	52	14.3	3.0	10.0	77.0
9	25	55	14.0	33.0	10.5	80.0
9	22	43	15.0	7.0		
9	27	38	15.2	6.2	11.5	98.5
9	22	44	15.0	53.0	8.9	73.0
9	25	50	13.0	11.0		93.0
9	27	56	12.8	20.0	8.5	78.5
9	26	54	11.9	54.0		78.6
9	30	45	13.4	9.1	8.5	72.9
9	44	52	13.5	13.0	9.8	97.2
9	35	45	13.5	13.0		
9	25		14.0	1.0	11.1	82.8
9	25	64	11.7	43.0	8.4	71.5
9	30	49	13.2	5.0	9.5	88.0
9	30	39	15.3	13.0	8.5	77.2
9	18	52	13.3	22.0		
9	15				9.8	99.0
9	30	62	12.7	20.0	10.1	77.6
9	30	59	13.0	26.0	8.1	68.8
9	18	40	15.2	3.0	10.9	85.0

## CAHPER FITNESS PERFORMANCE TEST SCORES, Continued

AGE	SIT-UPS	STANDING BROAD JUMP	SHUTTLE RUN	FLEXED ARM HANG	50 YARD RUN	300 YARD RUN
9	33					
9	35	47	13.5	13.0	9.7	80.0
9	35	35	14.7	11.5	10.0	74.6
9	04	35	14.8	7.0		93.0
9	24				9.8	82.0
9	36	63	15.0	58.0	8.6	72.5
9	36	51	15.8	24.0		
9	20	44	14.8	7.0		
10	18	57	14.0	98.0	9.4	
10	41	65	11.6	15.0	9.0	67.4
10	28	52	13.5	12.2	9.0	83.6
10	22	62	13.5	21.5	8.2	83.4
10	52	62	12.5	76.0	8.2	74.1
10	22	40	13.2	14.0	9.1	
10	31				9.2	
10	20	56	12.3	14.0	9.4	83.4
10	31	53	12.5	11.0	10.0	74.5
10		48		9.0		
10		52	13.5	23.0	9.0	77.0
10		44	14.4	7.5		
10	30	50	14.7	35.6		
10	29	53	13.9	10.8	8.3	82.0
10	35				8.7	81.2
10	10	39	17.0		9.5	91.0
10	15	55	13.3	60.0	10.0	74.0
10	31	57	12.8	12.8	8.4	88.0
10	34	55	13.4	35.0	9.1	77.4
10	22	48	14.6		10.1	88.1
10	38		12.8	20.0	9.5	
10	21	54	13.5	31.5	7.7	84.2
10	25	53	13.0	1.0	8.8	75.4
10	21	63	13.5	51.0	8.6	82.5
10	30		15.0		10.8	95.5
10	32	51	13.0	17.0	9.0	73.0
10	31	39	13.4	6.0	9.8	84.0
10	35	55	12.4	14.0	8.2	78.7
10		49	13.7	9.0	9.9	87.0
10	16	53	18.0	51.0	9.4	79.1
10	20	36	15.3	1.0	12.1	94.0
10	16	54	13.3	22.5	9.7	86.3
10	31	38	15.5	1.0	12.0	99.0
10	34	58	12.8	15.0	8.6	81.0
10	45	61	12.7	34.0	8.6	
10	16	57	11.9	8.5		
10		50	13.9	28.0	10.5	87.0
10	25	54	12.2	19.0	10.4	83.0
10	39	47	11.6	17.0		

## CAHPER FITNESS PERFORMANCE TEST SCORES, Continued

AGE	SIT-UPS	STANDING BROAD JUMP	SHUTTLE RUN	FLEXED ARM HANG	50 YARD RUN	300 YARD RUN
10	30	48	14.0	11.5		
10	37	43	14.4	25.0	10.0	81.9
10	26	51	12.2	6.5	12.1	86.0
10	25	57	12.1	36.0	8.1	70.0
10	33	57	12.0	33.0		
11	29	45	14.0	18.0	9.2	81.6
11	25	55	12.5	30.0	9.1	77.8
11	28	60	12.6	19.1	8.6	71.7
11	29	59	14.0	12.0	8.6	82.9
11	24	56	13.2	11.5	9.1	74.5
11		38	14.4	2.0		
11	25	58	12.6	26.5	8.0	76.8
11	30	52	14.2	2.0	9.5	89.5
11	18	56	13.2	1.0	9.0	87.9
11	45	59	12.0	56.0	8.4	70.2
11	56	67	11.7	61.0	7.5	67.8
11	17	43	14.5		10.6	82.0
11	29	58	1.13	20.6	7.6	75.4
11	28	53	14.6	20.0	9.1	71.5
11	35	61	13.2	21.0	8.5	80.3
11	34	56	12.5	27.0	9.7	60.5
11	30	67	12.4	13.5	8.4	79.6
11	44	74	10.6	62.0	7.2	61.5
11	29	73	12.5	39.0	8.4	75.5
11	34	59	11.9	39.0	8.9	71.0
11	46	62	12.2	14.1	8.1	76.9
11	30		13.0	20.0	9.1	71.0
11	23	57	13.7	23.0	8.6	81.5
11	30	54	13.3	60.0	9.4	
11	27	51	12.7	16.2	8.6	76.2
11	45	63	12.4	54.0	9.2	72.4
11				12.0		
11	39	52	13.8	51.0	9.0	69.0
11	27	31	12.8	12.1	10.2	88.5
11	32	60	12.3	55.0	8.7	69.6
11	19	52	13.8	9.8	9.0	
11	25	49	14.3	1.0	10.6	89.6
11		52	11.9	37.0	9.0	68.0
11	35	52	12.5	22.0	9.0	72.0
11	31	59	12.4	24.0	9.3	75.9
11	15	39	13.4	1.0	11.1	93.0
11	31		12.6	39.0	8.6	76.2
11	17	57	13.0	24.0	8.8	74.5
11	27	59	12.1	22.0	8.8	71.5
11	24	59	12.6	16.0	9.9	76.2
11	30	67	12.0	20.0	9.2	
11	27	66	12.7	20.0	9.7	70.0

## CAHPER FITNESS PERFORMANCE TEST SCORES, Continued

AGE	SIT-UPS	STANDING BROAD JUMP	SHUTTLE RUN	FLEXED ARM HANG	50 YARD RUN	300 YARD RUN
11	30	54	13.0	26.0	9.3	78.8
11	18	40	12.6	16.0	9.1	65.0
11	25	54	13.7	23.0	9.0	
11	33	58	12.0	35.0	9.0	70.0
12	22	59	12.4	11.0	8.5	79.3
12	22	50	13.5	14.0	10.5	80.1
12	21	40	13.6	1.0	10.0	99.8
12	37		11.4	63.0	8.5	66.0
12	31	59	11.3	39.0	7.8	64.5
12	07		14.1	9.0	10.1	
12	27	64	13.0	25.0	8.5	71.0
12	22	53	13.4	16.0	8.2	
12	31	57	11.7	53.0	9.1	78.1
12	30	49	12.7	26.0	10.1	80.2

## CAHPER FITNESS PERFORMANCE TEST SCORES

BOYS

AGE	SIT-UPS	STANDING BROAD JUMP	SHUTTLE RUN	FLEXED ARM HANG	50 YARD RUN	300 YARD RUN
6	02	26	16.0	14.3	10.8	99.9
6	20	53	18.8		9.3	77.5
6	0	30	16.0			
6	24	47	12.5	11.0	9.7	95.0
7	21	47	13.4	9.2	10.4	80.5
7	12	45		2.8	9.5	88.7
7	19	41	15.3	5.2	9.4	93.3
7	26	55	12.5	12.7		
7	18	43	14.5	9.0	9.2	82.7
7	10	44	12.8	41.0	10.0	90.5
7	25	49	13.0	54.5	9.3	77.0
7	19	35	15.7	5.5		
7	36	40	12.5	39.8	9.3	74.5
7	22	51	12.6	14.0	9.5	79.8
7	31	43	13.6	11.5	10.2	96.2
7	13	47	14.3	10.5	10.7	83.2
7	24	54	13.5	19.0	9.4	82.4
7	41	37	12.4	5.2	9.4	78.1
7	25	51	13.5	18.0	10.1	96.2
7	29	41	14.6	30.0	10.8	92.8
7	31	49	14.1	16.5	9.0	73.9
7	36	52	13.2	14.8		
7	28	49	12.2	19.7	9.8	80.3
7	21	43	15.2	14.5	10.3	88.0
7	31	43	13.9	9.5	9.8	80.1
7	17	42	15.6	13.8	10.0	83.9
7	04	40	13.6	10.2	11.2	98.5
7	0	38	13.6	6.2		
7	19	35	16.5	9.2	11.2	97.2
7	21	45	14.1	10.7	9.7	80.9
7	06	40	13.7	8.8	11.0	83.8
7	25	46	14.1			
7	19	40	14.2	4.5	11.3	93.9
7	24	41	14.5	54.0		
7	24	51	13.8	17.1	9.6	78.9
7	42	63	15.1	63.0	9.3	89.1
7	12	58	14.5	15.8	9.5	81.2
7	29	40	15.4	16.5	9.2	80.9
7	25	37	14.8		10.6	84.5
7	27	41	12.4	26.0	9.5	85.6
7	22	43	12.6	2.3	9.8	80.5
7	32	42	15.0	7.5	9.8	99.8
7	20	60	13.0		9.8	76.9
7	10	42		1.0	11.0	87.4
7	0	55	13.0	10.5	9.7	75.8
7	24	41	14.5	54.0		

## CAHPER FITNESS PERFORMANCE TEST SCORES, Continued

AGE	SIT-UPS	STANDING BROAD JUMP	SHUTTLE RUN	FLEXED ARM HANG	50 YARD RUN	300 YARD RUN
7	23	47	13.1	18.2	10.0	83.9
7	15	56	14.5	26.5	9.5	76.4
7	14	48	12.8		7.6	
8	40	50	12.6	25.0	8.9	78.3
8	27	54	12.6	26.4	9.2	
8	17	55	12.8		9.8	77.0
8	40	64	11.6	65.5	9.1	72.0
8	15	48	13.0	12.4	9.0	76.4
8	21	37	15.9	15.3	9.5	82.5
8	40	54	12.3	22.3	10.5	74.0
8	32	44		32.0	8.8	77.2
8	12	46	13.7	19.2	10.3	86.3
8	18	49	12.8	15.8		
8	26	51	13.1	11.2	10.4	82.6
8	27	51	12.0	13.8	9.4	85.3
8	04	32	15.8	7.2	11.7	84.7
8	31	41	14.5	14.7		
8	44	61	12.5	34.5	8.5	72.0
8	27	53	14.3	3.2	9.8	83.5
8	28	44	13.7	6.0		
8	24	43	13.4	19.8	9.0	71.8
8	03	49	14.7	3.8	9.2	90.9
8					9.0	79.8
8	21	42	14.0	12.9	10.3	82.1
8	12	49	14.2	11.6	10.1	82.7
8	10	52	12.7		9.3	74.5
8	04	55	14.2	4.3	10.0	84.8
8	27	42	13.5	6.3	11.8	96.5
8	39	52	12.7		8.4	71.0
8	23	32	11.4	11.8	8.9	72.8
8	20	56	12.5		9.0	73.1
8	33	47	12.8	47.0	9.0	79.5
8	15	57	14.2	49.1	8.7	68.5
8					9.8	82.5
8	31	53	13.4	9.3	8.8	73.3
8	21	42	14.7	8.9	10.6	88.0
8	11	37	11.6	19.1		
8	17	43	13.8	5.1	10.3	85.2
8	23	43	13.0	26.5	9.3	75.6
8	18	51	12.0	30.6	8.9	76.9
8	19	52	12.8	15.0		
8	16	54	12.6		9.4	81.1
8	21	38	13.8		9.7	82.3
8	06	38	12.7	14.8		
8	32	45	13.5	16.0		
8	04	40	15.8	9.2		
8	20	40	16.0	4.0	10.3	81.5
8	18	41	14.5	13.4	9.4	83.2

## CAHPER FITNESS PERFORMANCE TEST SCORES, Continued

AGE	SIT-UPS	STANDING BROAD JUMP	SHUTTLE RUN	FLEXED ARM HANG	50 YARD RUN	300 YARD RUN
9	29	53	11.9	19.5	8.0	75.0
9	30	62	12.0	12.0	8.2	72.8
9	44	67	11.8	65.7	8.0	69.4
9	57	70	11.5	40.3		79.6
9	27	41	12.6	10.4	9.1	72.1
9	30	44	14.0	4.5	9.8	92.0
9	20	61	11.2	91.5	9.3	
9	41	66	11.5	37.4		73.6
9	33	43	13.9	15.8	9.0	94.1
9	24	63	11.6	13.5	9.5	70.0
9	28	55	12.0	9.1	9.3	77.0
9	01	35	14.6	0	10.8	99.8
9	31	57	13.7	15.0	10.4	89.0
9	39	57	12.8	17.2	8.7	70.0
9	04	42	13.3	5.1	10.2	87.5
9	30	64	11.5	29.7	10.4	76.4
9	28	44	12.8	21.0	9.3	75.5
9	24	56	12.2	7.5	8.7	70.0
9	26	32	12.5	2.8	9.5	78.7
9	20	54	12.0	27.3	10.1	81.4
9	20	48	13.2	9.6	8.5	78.1
9	25	53	12.0	7.0	8.8	76.8
9	32	57	14.0	9.3	9.6	75.0
9	38	58	11.7	34.6	9.3	77.2
9	30	48	11.5	14.5	8.7	76.8
9	42	56	10.8	62.0	8.1	73.4
9	23	56	12.5	45.0	9.5	72.0
9	31	52		42.0	9.0	72.4
9	28	65	12.3	68.0	9.5	79.3
9	47	62	11.7	22.0	8.5	83.4
9	15	51	12.5	18.0	8.3	86.6
9	32	56	11.5	57.4	9.5	86.0
9	35	52	13.1	62.7	8.3	79.2
9	29	58	13.2	92.0	9.2	77.0
9	05	51	12.1	17.5	10.0	85.0
9	41		11.1		9.6	76.0
9	26	54	12.1	35.7	8.5	72.1
9	30	48	11.1	59.5	9.4	76.0
9	42	51		9.2	8.7	80.2
10	19	57	12.6	9.2	9.0	75.6
10	55	70	12.7	57.0	9.2	73.5
10	14	57	12.2	18.0	10.4	75.0
10	31	59	12.1	44.0	9.0	73.0
10	18	53	13.5	18.4	10.0	76.6
10	27	56	13.0	36.0	9.0	78.8
10	23	52	13.9	22.0	8.3	81.4
10	39	52	12.2	31.0	9.0	72.5

## CAHPER FITNESS PERFORMANCE TEST SCORES, Continued

AGE	SIT-UPS	STANDING BROAD JUMP	SHUTTLE RUN	FLEXED ARM HANG	50 YARD RUN	300 YARD RUN
10	48	66	12.0	18.9	8.6	75.0
10	35	66	9.9	16.5	7.6	68.0
10	38	60	12.5	77.3	9.5	75.2
10	30	46	11.6	48.0	8.1	73.0
10	23	50	12.8	65.1	9.7	77.6
10	55	55	12.2	26.5	10.0	71.4
10	19	31	13.8	3.7	9.2	79.9
10	10	32		1.0	8.7	96.5
10	45	55	12.5	27.0	7.9	73.0
10	23	48	11.9	8.5	8.5	76.4
10	35				9.1	78.2
10	27	65	12.0	20.0	8.8	75.8
10	41	58	12.1	29.5	9.0	69.0
10	28	59	12.5	8.0	8.5	80.0
10	44	68	11.0	70.0	8.5	70.0
10	37	61	12.6	48.0	10.0	70.1
10	33	63	12.2	39.0	8.3	73.0
10	30	52	13.6	9.3	9.0	76.4
10	56	60	11.8	73.9	8.1	55.2
10	29	56	12.0	26.0	9.0	71.0
10	27	48	12.9	62.9		
11	41	70	12.0	44.8	8.0	65.2
11	38	53	12.3	30.0	7.7	70.7
11	33	46	12.9	14.0	8.3	75.2
11	45	38	12.6	64.3	9.5	73.0
11	11	47		9.0		
11	21	54	13.0	13.5	9.0	73.5
11	43	63	11.8	35.5	7.6	68.2
11	35	63	11.9	70.0	9.5	72.0
11	50	73	11.5	60.0	8.8	67.7
11	16	33	13.2	6.0	10.5	88.0
11	30	48	13.5	12.5	9.3	77.0
11	52	60	12.7	80.5	8.0	64.0
11	34	62	12.8	44.0	8.1	64.0
11	41	65	12.1	39.0	8.0	71.8
11	38	54	13.5	81.0	9.0	75.3
11	21	53	13.2	3.5	10.0	78.8
11	30	60	13.3	14.0	9.2	74.3
11	30	40	12.1	13.0	9.0	73.4
11	25	62	12.3	10.0	10.0	72.7
11	46	50	12.6	14.0	8.5	69.2
11	33	61	11.8	20.5	8.0	75.0
11			13.0		8.5	74.5
11	30	58	11.7	41.0	9.0	69.4
11	39	58	13.4	35.0	9.5	71.1
11	30	48	13.1	60.0	8.5	68.8
11	28	61	12.3	42.5	9.0	67.5



## CAHPER FITNESS PERFORMANCE TEST SCORES, Continued

AGE	SIT-UPS	STANDING BROAD JUMP	SHUTTLE RUN	FLEXED ARM HANG	50 YARD RUN	300 YARD RUN
11	38	55	11.8	29.0	9.0	67.0
11	24	59	11.8	81.8	8.0	74.3
11	34	54	12.7	31.0	9.0	72.2
11	35	63	14.0		8.5	77.5
11	41	55	11.2	29.0	8.0	67.9
12	25	78		55.0		
12	40	61	11.9	61.0	8.7	70.3
12	32	56	12.8	53.0	9.6	67.8
12	40	64		24.0	9.0	68.9
12	20	56		11.0		
12	62	78	10.0	76.0	7.2	59.0
12	39	67	13.0	20.2	9.0	71.2
12	30	60	13.2	12.8	11.0	75.3
12	18	58	12.5	11.0	9.2	75.0
12	47	52	13.5		9.6	80.0
12	42	67	12.4	26.0	8.0	62.0
12	33	57	12.8	12.1	9.0	77.5
12	55	66	12.1	82.5	7.8	62.4
12	33	64	12.4	23.0	8.2	77.9
12	34	63	12.3	50.0	8.0	68.6
12	42	56	11.8	11.8	8.6	70.3
12	22	63	12.5	40.5	8.5	70.0
12	25	65		34.1	9.0	72.5
12	39	64	12.0	18.0	8.5	71.2
12	18	55	12.5	15.8	9.0	72.0
12	23	50	12.6	15.8	9.1	84.0
12	25	72	12.1	33.2	8.2	66.3
12	36	48	12.7	40.1	9.0	77.3
12	38	49		83.0		
12	27	48	15.0		8.2	73.6
12	36	61	11.2	21.0	9.3	75.1
12	30	47	13.4	39.9	10.0	79.0
12	43	66	10.9	40.9	8.7	70.5
12	35	53	12.3	31.8	8.0	70.0
12	36	64		61.0		
12	30	54	11.9	44.0	8.1	72.2
12	45	53	12.4	92.0	8.4	70.0
12	15	42	15.3	0.0	10.0	97.0
12	50	78	12.6	75.0	8.2	64.2
12			12.8		8.6	75.0

## APPENDIX F

## CRAWFORD AND VIRGIN MOTOR ABILITY TEST

## RAW SCORES

6 YEAR OLD GIRLS

AGILITY RUN	THROW	STORK STAND	JUMP AND CLAP
9.0	4	8.6	30.0
8.8	1	9.0	4.0
9.2	6	14.0	11.0
8.9	7	9.0	21.0
9.2	1	8.0	3.0
9.8	5	9.0	23.0
11.2	4	5.3	6.5
9.8	1	4.9	6.0
9.7	2	7.4	6.0
9.6	4	7.0	1.0
8.6	0	11.0	30.0
9.2	0	8.0	27.0
8.5	3	5.0	30.0
10.8	5	11.0	13.0
9.9	10	21.0	5.0
9.8	0	9.3	21.0
9.8	4	5.3	6.0
10.2	1	12.1	5.5
10.5	4	5.5	1.2
14.8	3	6.5	17.0
10.2	5	8.3	2.0
11.3	4	6.2	4.2
10.7	9	6.7	6.8
9.8	6	6.4	30.0
10.0	3	8.0	18.0
8.9	8	10.0	8.0
9.8	5	5.0	17.0
10.1	0	28.0	12.4
10.2	5	10.0	30.0
9.1	9	13.2	30.0
10.0	3	40.0	11.4
10.2	6	4.0	22.0
10.4	6	5.0	26.0
9.2	4	8.0	13.0
10.0	0	7.5	30.0
9.5	5	11.0	13.0
8.8	4	13.0	19.0
7.5	4	5.0	8.0
8.4	3	9.0	16.0
9.5	4	34.4	30.0
10.2	7	18.5	10.5
9.0	2	13.9	30.0
9.3	9		

## CRAWFORD AND VIRGIN MOTOR ABILITY TEST RAW SCORES, Continued

6 YEAR OLD BOYS

AGILITY RUN	THROW	STORK STAND	JUMP AND CLAP
10.9	8	11.4	30.0
7.3	10	46.1	22.7
9.3	8	40.3	9.0
10.0	3	5.0	5.0
13.4	1	3.8	11.0
13.5	6	8.3	13.0
11.8	3	13.8	8.0
9.0	5	11.6	30.0
10.0	10	6.6	7.0
9.8	8	7.1	4.0
10.1	9	8.0	6.0
9.6	5	6.6	1.0
9.3	6	14.2	3.0
9.4	5	5.4	1.9
9.4	8	15.9	12.3
9.8	7	10.1	2.0
11.9	8	4.6	4.0
10.7	10	33.0	30.0
10.9	3	11.1	8.0
10.2	8	10.3	25.7
9.3	2	16.9	30.0
10.4	7	8.5	1.8
11.4	5	6.5	15.4
11.8	3	18.5	26.0
8.7	4	21.0	5.0
8.8	2	19.0	20.0
7.8	9	16.0	8.5
9.8	0	6.0	14.8
8.0	3	7.0	3.4
9.4	5	32.0	3.0
10.6	4	8.5	2.3
9.2	10	5.9	12.2
9.4	6	4.8	6.3
8.2	9	20.2	5.0
9.2	5	11.1	2.3
9.3	5	17.0	4.3
10.8	3	33.0	4.8
9.1	2	4.5	8.7
9.2	6	6.0	19.7
9.8	3	7.0	14.0
10.0	5	7.0	8.2
9.3	8	7.5	27.0
10.8	2	7.0	13.0
10.8	0	7.0	6.0
8.2	6	7.5	11.0
10.6	0	3.0	16.0

## CRAWFORD AND VIRGIN MOTOR ABILITY TEST RAW SCORES, Continued

6 YEAR OLD BOYS, Continued

AGILITY RUN	THROW	STORK STAND	JUMP AND CLAP
11.2	3	32.0	4.0
9.3	0	6.0	19.5
9.0	2	3.0	4.0
8.5	6	10.0	27.0
10.5	3	4.0	6.0
7.4	4	14.0	24.0
11.6	6	4.0	6.0
8.1	5	6.3	2.0
10.8	9	10.4	5.9
8.6	8	9.0	24.0

## CRAWFORD AND VIRGIN MOTOR ABILITY TEST RAW SCORES, Continued

10 YEAR OLD GIRLS

AGILITY RUN	ALTERNATE WALL TOSS	SOCCER BALL THROW	TOE TOUCH
6.9	5	2	5
7.4		3	5
7.4	7	4	5
7.3	3	1	2
7.0		8	5
7.8	5	5	5
8.5	8	3	0
6.0	6	5	4
7.1		3	4
8.2	7	4	5
9.0	2	5	
7.3		3	4
7.7		0	3
7.5	11	7	5
7.8	1	6	0
6.7		8	2
9.8	2	3	0
7.7	0	5	1
8.6	8	2	0
7.3	0	5	0
6.8	3	6	3
6.0	1	8	1
7.0		2	5
6.8	1	8	5
7.0	0	4	4
8.0	4	6	4
7.4	15	6	5
7.3	9	2	0
7.5	2	4	0
7.1	3	2	5
8.8	3	2	0
8.2	7	0	0
7.5	0	0	3
7.4	1	6	4
7.7	2	2	0
8.5	3	6	0
7.1	8	7	0
8.5	0	4	5
6.8	0	7	0

## CRAWFORD AND VIRGIN MOTOR ABILITY TEST RAW SCORES, Continued

10 YEAR OLD BOYS

AGILITY RUN	ALTERNATE WALL TOSS	SOCCER BALL THROW	TOE TOUCH
7.2	16	6	5
7.5	12	3	1
7.2	16	5	5
7.5	20	6	5
7.7	14	9	5
8.2	6	6	3
10.0	12	8	0
8.0	2	3	0
8.0	1	1	2
6.6	9	3	5
7.0	12	6	3
8.0	0	2	5
6.8	4	5	3
6.7	9	6	5
7.8	3	5	5
6.3	3	5	4
7.0	8	4	1
6.2	9	4	5
7.2	12	5	5
7.0	15	6	4
7.5	9	6	4
9.0	2	3	2
7.8	8	3	4
6.7	15	6	5
7.7	7	1	5
8.2	4	1	1
7.4	0	0	5
6.8	10	8	5
8.0	2	1	3

## APPENDIX G

## Cell Numbers for CAHPER Results

Age	Male			Female		
	West End	Van- Couver	Canada	West End	Van- Couver	Canada
7	40	32	50	42	32	50
8	39	34	50	46	32	50
9	38	32	50	40	33	50
10	28	34	50	38	35	50
11	30	34	50	43	35	50
12	32	36	50	12	36	50