



**Action Schools! BC**

[www.actionschoolsbc.ca](http://www.actionschoolsbc.ca)

**PHASE I (PILOT) EVALUATION REPORT  
AND RECOMMENDATIONS**

**NOVEMBER 2004**

**Action Schools! BC  
Phase I (Pilot) Evaluation Report and Recommendations  
A Report to the Ministry of Health Services**

**November 2004**

**Principal Investigator:**

Heather McKay MSc, PhD  
Associate Professor  
Department of Orthopaedics/Family Practice  
Faculty of Medicine  
University of British Columbia

**Contributors:**

J.P. Chanoine	Y. Ahamed
J. Fenton	K. Ercikan
B. Kopelow	J. House
K. MacKelvie-O'Brien	R. Levy Milne
P.J. Naylor	H. Macdonald
R. Rhodes	K. Reed
J. Zebedee	D. Warburton

# Table of Contents

Glossary Of Terms and Acronyms .....	4
Executive Summary .....	7
1. Introduction .....	10
1.1 What is Action Schools! BC? .....	10
1.2 The Action Schools! BC Vision .....	11
1.3 Four Health Targets .....	11
1.4 The Purpose of this Report .....	12
2. The State of the Health of B.C. Children – The rationale behind <i>Action Schools! BC</i> .....	13
2.1 The Health Impact of Physical Inactivity and Unhealthy Eating.....	13
2.2 B.C. Physical (In) Activity and Body Weight Profile .....	13
2.3 Costs Attributable to Physical Inactivity, Overweight and Obesity in British Columbia.....	15
2.4 Why focus on children? .....	16
3. <i>Action Schools! BC</i> .....	17
3.1 <i>The Action Schools! BC Model</i> .....	17
3.2 <i>Action Schools! BC Components</i> .....	17
3.2.1 Action Zones .....	17
3.2.2 The Action Team .....	19
3.2.3 The Action Plan .....	19
3.2.4 Whole School Action .....	19
3.2.5 Classroom Action.....	20
3.2.6 Healthy Eating - The 5-TODAY Model .....	20
3.2.7 Teacher Training and Resources.....	21
3.2.8 The School Community.....	22
3.2.9 The Larger Community.....	22
4. The Evaluation .....	23
4.1 Who Was Evaluated? .....	24
4.1.1 School and Student Recruitment .....	24
4.1.2 Socio-economic Status of Target School Districts.....	25
4.1.3 Ethnicity of Target Schools Districts .....	28
4.1.4 Study Design.....	27
4.2 What Was Evaluated? .....	29
4.2.1 Measurement .....	29
4.2.2 Anthropometry.....	29
4.2.3 Physical Activity and Performance .....	29

4.2.4	Healthy Hearts .....	30
4.2.5	Healthy Weight .....	30
4.2.6	Healthy Eating.....	31
4.2.7	Healthy Bones.....	32
4.2.8	Healthy Self.....	32
4.2.9	Academic Performance .....	33
4.2.10	Process Evaluation .....	33
5.	The Results - What Did We Find?.....	34
5.1	<b>Physical Activity</b> .....	34
5.2	<b>Healthy Hearts</b> .....	40
5.3	<b>Healthy Weight</b> .....	45
5.4	<b>Healthy Bones</b> .....	49
5.5	<b>Healthy Self</b> .....	52
5.6	<b>Healthy Eating</b> .....	53
5.7	<b>Academic Performance</b> .....	54
5.8	<b>Process Evaluation</b> .....	56
6.	Conclusions .....	60
7.	Recommendations .....	61
Appendix 1:	<i>Action Schools! BC</i> – Organization Chart.....	64
Appendix 2:	<i>Action Schools! BC</i> Action Plan .....	65
Appendix 3	<i>Action Schools! BC</i> – Weekly Activity Log .....	68
Endnotes	.....	69

## Glossary Of Terms and Acronyms

<i>AS! BC</i>	<i>Action Schools! BC</i>
<b>AS! BC Evaluation Team</b>	The research team that conducted the measurement and evaluation portion of the <i>Action Schools! BC</i> pilot project.
<b>AS! BC Support Team</b>	The central support team that facilitated and provided support to the Action Teams.
<b>Action Pages</b>	Contain comprehensive lists of physical activity and healthy eating resources to support the Action Plan.
<b>Action Plan</b>	A planning tool to support the integration of physical activity and healthy eating initiatives into the school culture. Involves Action Teams in setting annual goals and identifying actions.
<b>Action Team</b>	A school-based group comprised of teachers, resource staff, administrators, Parent Advisory Committee members and community practitioners involved with developing and supporting the implementation of the Action Plan.
<b>Anthropometry</b>	Measurement of height, weight and other dimensions of human beings, especially at different ages, or in different races, occupations, etc.
<b>BCNS</b>	British Columbia Nutrition Survey
<b>BMI</b>	Body Mass Index - A simple index of body fatness calculated by dividing body weight in kilograms by height in metres squared (kg/m <sup>2</sup> ).
<b>Chronic Disease<sup>1</sup></b>	Diseases that have one or more of the following characteristics: <ul style="list-style-type: none"><li>• Are permanent,</li><li>• Leave residual disability,</li><li>• Are caused by no reversible pathological alteration,</li><li>• Require special training of the patient for rehabilitation, or</li></ul>

- May be expected to require a long period of supervision, observation, or care.

<b>Classroom Action 15x5</b>	A model of choices that provide 15 minutes of physical activity each day of the school week, for a total of 75 additional minutes per week.
<b>Action</b>	A service, program, intervention, strategy, policy change or other activity that is implemented with the intent of preventing chronic disease and/or promoting healthy living.
<b>C-reactive Protein</b>	A general indicator of tissue and blood vessel damage.
<b>CVD</b>	Cardiovascular Disease. Includes ischemic heart disease, stroke, congestive heart failure, aortic aneurysm and others.
<b>Fibrinogen</b>	A major determinant of blood viscosity that plays a key role in blood clotting.
<b>Healthy Eating</b>	A pattern of eating that meets guidelines set out in Canada's Food Guide to Healthy Eating, thereby promoting good health and lowering risk of chronic disease. Measured by the proportion of population age twelve years and over who consume fruits and vegetables more than five times per day.
<b>HDL</b>	High density lipoprotein - Commonly known as "good cholesterol."
<b>Homocysteine</b>	An amino acid derived from protein breakdown that can damage blood vessels if levels become too high.
<b>Indicator</b>	A characteristic of an individual, population, or environment, which is subject to measurement (directly or indirectly) and can be used to describe one or more aspects of the health of an individual or population.
<b>Intervention</b>	A program designed specifically to alter the physical characteristics or behaviours of a group.
<b>Intervention Groups</b>	<i>Action Schools! BC Liaison and Champion schools.</i>

<b>LDL</b>	Low density lipoprotein. Commonly known as “bad cholesterol.”
<b>Ministry</b>	Ministry of Health Services (Government of British Columbia)
<b>NS</b>	Not Significant
<b>Obese<sup>2</sup></b>	A body mass index (BMI) equal to or greater than 30.
<b>Overweight</b>	A body mass index (BMI) between 25 and 29.9.
<b>PHSA</b>	Provincial Health Services Authority
<b>Physically Active<sup>3</sup></b>	“Active” level of physical activity defined as expending <i>more</i> than 1.5 kcal/kg/day of energy.
<b>Physically Inactive</b>	“Inactive” level of physical activity defined as expending <i>less</i> than 1.5 kcal/kg/day of energy.
<b>Risk Factor<sup>4</sup></b>	Any attribute, characteristic or exposure of an individual, which increases the likelihood of developing a disease or injury.
<b>SPSS</b>	A statistical analysis program.
<b>Target Outcome</b>	The intended change in a characteristic (as measured by an indicator) of an individual, group or population that is attributable to a planned intervention or series of interventions.
<b>Triglycerides</b>	A lipid with a positive association with cardiovascular disease.
<b>UBC</b>	University of British Columbia
<b>VGH</b>	Vancouver General Hospital

## Executive Summary

*Action Schools! BC* is a best-practice physical activity model designed to assist elementary schools in creating individualized action plans to promote healthy living. *Action Schools! BC* provides resources and recommendations for the creation of individualized Action Plans that integrate physical activity and healthy eating into the school environment.

*Action Schools! BC* was developed in response to the current crisis in children's health, concerns about childhood physical inactivity and the escalating levels of childhood obesity. These issues are major public health concerns that threaten to substantially increase the burden of chronic disease in BC.

Between February 2003 and June 2004, Phase I of the *Action Schools! BC* initiative was conducted at the grades four to seven levels in ten pilot schools in the Vancouver and Richmond school districts. The pilot program included a comprehensive evidence-based health outcome evaluation. The purpose of the evaluation was to determine the effectiveness of the *Action Schools! BC* model in providing sufficient levels of physical activity and healthy eating education in the school environment and the physical impact it had on the health of the participating children. Students, teachers, administrators and parents participated in the evaluation.

The ten participating schools were stratified based on size, geographic location and ethnicity and randomly assigned to one of three groups:

- *Liaison Schools* (4 total): In which *Action Schools! BC* provided a dedicated Master Trainer and all required resources to administer the *Action Schools! BC* model,
- *Champion Schools* (3 total): In which *Action Schools! BC* provided a contact person who supported a champion designated from within the school community, and
- *Usual Practice Schools* (3 total): Which continued their usual physical activity and health programs without intervention from the *Action Schools! BC* team.

Evaluation was conducted in the following areas:

- Physical Activity
- Healthy Hearts (Cardiovascular health)
- Healthy Weight
- Healthy Eating (Dietary intake)
- Healthy Bones
- Healthy Self (Psycho-social health)
- Academic Performance
- Process Evaluation

The baseline information collected indicated that there is clear cause for concern for the health and physical inactivity level of children in B.C. For example:

- Girls were less physically active than boys;
- Forty-five per cent of Action Schools! BC children were not meeting health guidelines for physical activity of 60 minutes per day or 10,000 steps per day
- One in six boys and one in ten girls in *Action Schools! BC* schools were overweight;
- Fifty-five per cent of the participant children displayed at least one cardiovascular disease risk factor;
- Ninety-one per cent of the *Action Schools! BC* participant girls and 84 per cent of boys<sup>5</sup> were not meeting the recommended daily intake of 1300 mg per day of calcium; and
- None of the children were meeting the minimum recommendation of five servings of fruit and vegetables per day.

The evaluation results showed that *Action Schools! BC* had a positive influence on the physical activity level of students in the Liaison and Champion schools, with a significant increase in minutes of physical activity opportunities provided, as compared to those in the Usual Practice schools. As a result of the increased physical activity, students in the Liaison and Champion schools showed a statistically significant improvement in their heart health, bone health, dietary requirement awareness and academic performance. The results of the process evaluation indicated that administrators, teachers and parent participants in the *Action Schools! BC* pilot initiatives were very satisfied with the model and supported its wider implementation.

The findings from the evaluation support the recommendations outlined in B.C. Provincial Health Officer's Report (October 2003): *An Ounce of Prevention – A Public Health Rationale for the School as a Setting for Health Promotion*:

- Recommit to support healthy schools initiatives;
- Develop and implement an evidence-based curriculum that runs from school entry to graduation as part of a comprehensive school health process;
- Develop an infrastructure at the provincial and regional levels to support implementation of comprehensive school health promotion; and
- Establish a formal mechanism whereby all related ministries and other stakeholders in child and youth health contribute to comprehensive school health promotion.

In addition, the following recommendations were derived from the evaluation of the *Action Schools! BC* Phase I pilot initiative.

- 1) Encourage and empower teachers to support the creation of healthy school environments and take an interest in the health of their students;
- 2) Educate teachers about the academic benefits of physical activity;
- 3) Focus on girls to encourage increased physical activity;
- 4) Focus on boys to encourage healthy body weight;
- 5) Focus on low active children to encourage increased physical activity;

- 6) Identify and intervene with those children at greatest risk for developing chronic disease;
- 7) Promote activities that develop a healthy skeleton;
- 8) Develop programs and activities aimed at improving self-concept in children;
- 9) Develop a comprehensive component on healthy eating;
- 10) Monitor the *Action Schools! BC* participants as they continue to grow to evaluate long-term benefits of the model;
- 11) Evaluate the effectiveness of the model on a population basis;
- 12) Expand the model to encompass Grades K-3 and Middle school; and
- 13) Engage government ministries across sectors to support a provincial plan of action to improve the health of BC children.

## 1. Introduction

*Action Schools! BC* utilizes a socio-ecological health framework to implement a school-based model that integrates physical activity and healthy eating to create a healthy school environment. *Action Schools! BC* pilot was introduced in September 2002 in ten schools (grades four to seven) in British Columbia's lower mainland. The pilot program included a comprehensive evidence-based health outcome evaluation.

### 1.1 What is *Action Schools! BC*?

*Action Schools! BC is a best-practices physical activity and healthy eating model designed to assist elementary schools in creating individualized action plans to promote healthy living.*

*Action Schools! BC* is an initiative that was developed in response to the current crises in children's health. *Action Schools! BC* was specifically designed to help children become more physically active and to increase children's awareness of healthy eating habits. The *Action Schools! BC* model was designed to provide low-cost resources to educators, parents and community groups to complement physical activity and healthy eating programs already in place.

*Action Schools! BC* represents a partnership between government, researchers, educators, and the health, recreation and sport sector. Partners in the development and implementation of the initiative include the B.C. Ministries of Health Services, Small Business and Economic Development, Education; 2010 LegaciesNow; and the University of British Columbia (UBC). The Ministry of Health Services provided funding, with additional financial support from the Ministry of Small Business and Economic Development - Sport Branch (formerly the Ministry of Children and Women's Services – Sport and Physical Activity Branch) and 2010 LegaciesNow.

*Action Schools! BC* is a unique model for promoting physical activity among children. Some of the key features of this novel initiative include:

- Utilizing existing best-practices resources that contribute to the development of a sustainable physical activity and school health model;
- Providing educators with the tools to customize school Action Plans to assist them in the development and implementation of a quality physical activity and healthy eating program;
- Utilizing established relationships and generating new partnerships between teachers, school administrators, families and community health, recreation and sport practitioners;

- Providing linkages across and between sectors, including:
  - The school community,
  - The larger community and community organizations,
  - The academic research community,
  - The Regional Health Authorities,
  - Three provincial government ministries, and
  - *2010 LegaciesNow*;
- Integrating a systematic evaluation of health and academic outcomes and program materials to provide evidence to support continued modification and implementation of the model; and
- Having the potential to increase physical activity and healthy choices, therefore decreasing chronic disease risk factors amongst participants.

## **1.2 The Action Schools! BC Vision**

The vision of Action Schools! BC is twofold:

- i. To integrate physical activity into the fabric of elementary schools, and maintain this integration through partnerships with family and community.
- ii. To achieve long-term, measurable and sustainable health benefits.

## **1.3 Four Health Targets**

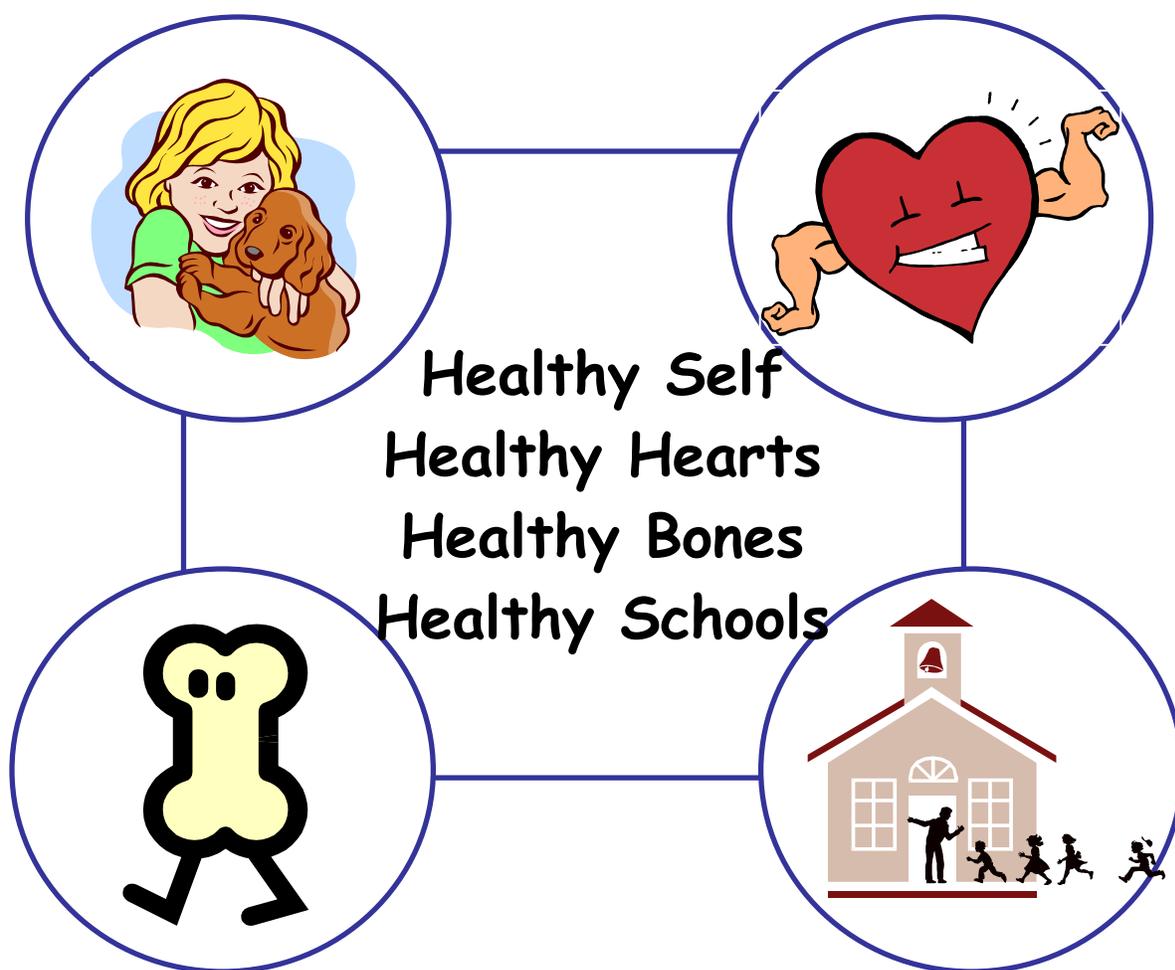
*Action Schools! BC* joins other programs across Canada that promote physical activity and healthy eating by Canadian children. By sharing and modifying existing programs and linking national, provincial and community-based programs with school-based programs, *Action Schools! BC* was designed to help elementary schools create action plans that promote children's health.

The *Action Schools! BC* model materials and school-based resources were developed and gathered based on four health targets that incorporate health and academic outcomes (Figure 1.1).

- Healthy Hearts – cardiovascular fitness
- Healthy Bones – skeletal health
- Healthy Self – muscle fitness, positive self-esteem, tobacco-use prevention and cessation, healthy weight and nutrition
- Healthy School - inclusive, safe healthy school communities

Through improvements in these four areas, *Action Schools! BC* aims to positively affect academic performance and create a healthy school community.

**Figure 1.1. The *Action Schools! BC* Model – Four health target areas.**



#### **1.4 The Purpose of this Report**

The purposes of this report are threefold:

- i. To provide a description of *Action Schools! BC* including an overview of the rationale behind the model.
- ii. To outline the findings of the evaluation that was conducted as part of Phase I – *Action Schools! BC*.
- iii. To provide recommendations for the future province-wide implementation of *Action Schools! BC*.

## **2. The State of the Health of B.C. Children – The rationale behind *Action Schools! BC***

*Action Schools! BC* was developed in response to recent attention to the health behaviours of children and youth, and in particular public concern over the growing epidemics of obesity and physical inactivity.

*“Although British Columbia continues to lead the country in the proportion of people with acceptable weight, there is a disturbing trend of increasing overweight and obesity among Canadian children. If it is not reversed, there will be serious consequences for future health.”*

P. R. W. Kendall, Provincial Health Officer (BC) – *Report on the Health of British Columbians. Provincial Health Officer’s Annual Report 2002. The health and well-being of people in British Columbia. 2003.*

### **2.1 The Health Impact of Physical Inactivity and Unhealthy Eating**

Physical inactivity and unhealthy eating are leading risk factors contributing to the growing burden of chronic disease and to the emergence of an epidemic of overweight and obesity. In addition to the major chronic diseases (e.g.: cardiovascular disease, type II diabetes and certain types of cancer), other diseases with serious health impacts, such as osteoporosis and dental caries, are associated with physical inactivity and unhealthy eating. Overweight and obesity can increase the risk of diabetes by 48 per cent.<sup>6</sup> Debilitating health problems associated with obesity and overweight include respiratory difficulties, chronic musculoskeletal problems like osteoarthritis, skin problems and infertility. The negative health and social impacts of physical inactivity and poor nutrition during early years of life can last a lifetime.

### **2.2 B.C. Physical (In) Activity and Body Weight Profile**

British Columbians (age 12 years and over) are the most physically active, in comparison with similar populations of the other Canadian provinces. At the same time, B.C. also has the lowest percentage of the population who are inactive. The physical inactivity rate among adult females (41.8 per cent) is statistically significantly higher than that of adult males (35.9 per cent)<sup>7</sup>.

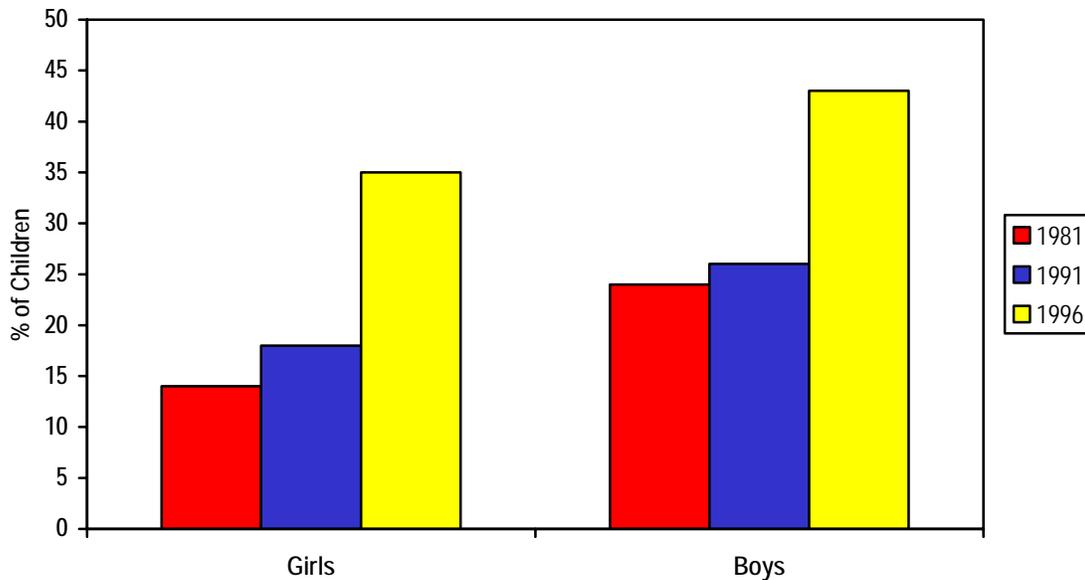
Notwithstanding these findings, the following information is indicative of some alarming trends among BC adults and children.

- i. Over 20 per cent of the burden of disease in BC is attributable to the risk factors of physical inactivity and obesity, while a further 12 per cent is attributable to tobacco-use.<sup>8</sup>

- ii. The recently published B.C. Nutrition Survey<sup>9</sup> found that over half (55 per cent) of B.C. adults were overweight (37 per cent) or obese (18 per cent) as measured by their Body Mass Index (BMI). This is markedly higher than the 44 per cent of overweight/obesity assessed ten years earlier in the 1989 B.C. Heart Health Survey. It is also higher than the 42 per cent prevalence estimated for BC adults in the Canadian Community Health Survey (which obtained self-reported data, rather than the actual measures obtained by the BCNS and the BC Heart Health Survey).<sup>10</sup> The study also found that overweight and obesity increased with age.
- iii. The 2003 Report of the BC Provincial Health Officer<sup>11</sup> identified the following patterns among BC children and youth.
  - 58 per cent of BC youth (ages 12 to 19) are not active enough for optimal growth and development.
  - BC teenagers consistently exercise less as they grow older.
  - The decrease in activity with age is a concern, as these increasingly sedentary habits will likely be carried into adulthood.
  - Only 55 per cent of males and 40 per cent of females in Grade 10 eat breakfast daily.
  - 61 per cent of BC youth (ages 12 to 19) consume less than five servings of fruits and vegetables per day, the minimum intake recommended by Canada's Food Guide to Healthy Eating.
  - More than 33 per cent of Canadian children are overweight and 15 per cent are obese.
  - BC children (ages 2 to 12) watch an average of 14.7 hours, and BC youth (ages 12 to 19) watch an average of 10.9 hours, of television per week.<sup>12</sup>

These alarming trends have contributed, over the last two decades, to a progressive increase in excess weight and obesity and physical inactivity among Canadian children. Obesity is now so common that it is replacing such public health concerns as under-nutrition and infectious disease as one of the most significant contributors to ill health worldwide.<sup>13</sup> There has been a progressive increase in excess weight and obesity in children. From 1981 to 1996 the prevalence of overweight increased by 92 per cent in boys and 52 per cent in girls (Figure 2.1).<sup>14</sup> One-third of Canadian children aged 2 to 11 were overweight in 1998/99.<sup>15</sup> Inactivity and unhealthy eating habits are the major contributing factors to these staggering trends.<sup>16</sup> These trends are of concern because of the growing evidence linking healthy child development to chronic disease prevention.

**Figure 2.1. Increase in the rates of obesity in Canadian children over a fifteen-year period (1981-1996).**



In order to address these concerns, there is a need to seriously consider how B.C. children live and play, and the food choices they and their families make.<sup>17</sup> *Action Schools! BC* has been designed to provide a comprehensive response to these issues.

### **2.3 Costs Attributable to Physical Inactivity, Overweight and Obesity in British Columbia**

Major chronic diseases and injuries in B.C. place a huge burden on the provincial economy, both in terms of direct health care costs and indirect costs, such as lost productivity and premature mortality.

British Columbia Ministry of Health Services' internal estimates indicate physical inactivity directly costs health care approximately \$200 million per year (hospital, physician, drug, institutional and other costs) and an additional \$350 million in lost economic opportunity through premature death and disability for a total cost of \$550 million annually.<sup>18</sup>

In a 2001 earlier study by Colman<sup>19</sup>, *obesity* was estimated to cost the province \$380 million in direct costs.<sup>20</sup> Indirect costs attributable to obesity are estimated at \$350-450 million annually. The total economic cost of obesity for B.C. in 1997 was estimated between \$730 million and \$830 million (between 0.8 per cent and 0.9 per cent of B.C.'s Gross Domestic Product).

The economic cost of physical inactivity is clearly very great. Increased physical activity would prevent much of these expenditures. In fact, studies have shown that ten per cent reduction in physical inactivity could result in savings of \$150 million per year in direct health care costs.<sup>21</sup>

## 2.4 Why focus on children?

*“To improve health over the long term, particular emphasis must be placed on critically sensitive periods during the lifespan, including prenatal, early childhood and the school years.”*

P. R. W. Kendall, Provincial Health Officer (BC) – *An Ounce of Prevention - A Public Health Rationale for School as a Setting for Health Promotion*, October 2003.

Infant and child development has been linked to adult health status. As was noted by the B.C. Provincial Health Officer<sup>22</sup>, there is growing evidence linking healthy infant and child development to chronic disease prevention. It seems that early life experience can ‘imprint’ both physiologically and psychologically in a way that can affect the expression of disease throughout life. This suggests that to improve health over the long term, particular emphasis must be placed on critically sensitive periods during the life span, including the prenatal, early childhood and the school years.

The importance of school programs that integrate physical activity, healthy eating and healthy school environments is underscored when considered in the context of the long periods of immobility associated with traditional academic learning. Children, influenced by powerful marketing, are directed toward sedentary activities such as television viewing and computer games and away from spontaneous play and movement. Additionally, a significant number of schools do not appear to be allocating the recommended 10 per cent of instructional time to physical education.<sup>23</sup> As many of the antecedents of adult chronic disease are present in childhood, when patterns of health behaviours are established, an effective program to reduce physical inactivity has the potential to improve cardiovascular and bone health risk factor profiles of children that can continue into adulthood. As well, healthy students perform better academically<sup>24</sup>, creating the opportunity for them to grow into more productive adults.

### **3. Action Schools! BC**

#### **3.1 The Action Schools! BC Model**

*Action Schools! BC* is a multi-phase, multi-discipline initiative developed in British Columbia. It uses a socio-ecological approach based on a comprehensive school health philosophy to target physical activity and healthy eating in elementary schools (grades four to seven).

*Action Schools! BC* provides an Action Model for targeting the school environment and involves families, teachers, principals and school districts in creating and implementing comprehensive plans to provide more physical activity and healthy eating opportunities throughout the school day. The purpose of *Action Schools! BC* is to make the healthy choices easy choices for children.

The model is consistent with the conceptualization of Health Promoting Schools<sup>25</sup> and Comprehensive School Health,<sup>26</sup> which relies on a whole-school approach and a large range of activities integrated into the school environment, rather than traditional classroom-based health education. The Action Model provides a tool for schools to create individualized Action Plans that contribute to the health of children, as well as the overall health and well-being of the school community. *Action Schools! BC* provides planning tools and recommendations based on a model of choices for the creation of Action Plans which integrate the efforts and actions of teachers, school administrators, families and community health, recreation and sport practitioners towards the school's health goals.

#### **3.2 Action Schools! BC Components**

##### **3.2.1 Action Zones**

*Action Schools! BC* promotes and facilitates the creation of a portfolio of inclusive and diverse physical activity opportunities for students throughout the school day. To support this, the *Action Schools! BC* Support Team developed intervention ideas in six identified Action Zones.

Examples of activities relevant to each zone include:

##### **Action Zone 1 School Environment**

*Makes healthy choices the easy choices by creating safe and inclusive school environments and supporting healthy living policy.*

- a) Presenting physical activities at school assemblies

- b) Placing healthy living and *Action Schools! BC* on the staff agenda
- c) Providing Professional Development opportunities
- d) Assess school health policy and the safety of the school environment

### **Action Zone 2    Scheduled Physical Education**

*Supports the curriculum goal to deliver 150 minutes of scheduled physical education per week.*

- a) Encouraging teachers to plan and share resources and success stories
- b) Providing an in-service for teachers and students that introduces new activities

### **Action Zone 3    Extra-Curricular**

*Balances classroom action and physical education with a variety of opportunities for students, staff and families to be physically active before and after school, and during lunch and recess.*

- a) Offering non-traditional intramurals
- b) Creating clubs that are accessible and fun for all students
- c) Making physical activity equipment available to all students before and after school

### **Action Zone 4    School Spirit**

*Cultivates school spirit by encouraging physical activity and celebrating the benefits of healthy living for the whole school.*

- a) Hosting *Action Schools! BC* kick-off assemblies
- b) Organizing physical activity events for students and school staff
- c) Incorporating physical activities and games that celebrate cultural uniqueness within the community

### **Action Zone 5    Family and Community**

*Fosters the development of partnerships with families and community practitioners to benefit from the wealth of available resources that promote and encourage healthy living.*

- a) Supporting students' gaining community activity experiences
- b) Providing nutrition workshops
- c) Making presentations to the schools' Parent Advisory Councils

## **Action Zone 6 Classroom Action**

*Provides creative, alternative classroom physical activity ideas that complement scheduled physical education, support the curriculum, and build healthy bones, hearts, muscles and selves.*

- a) Encouraging teachers to implement the *Action Schools! BC Classroom Action 15x5*
- b) Providing each classroom with teaching resources and bins of equipment
- c) Integrating nutrition and healthy living into the daily routine of the class

### **3.2.2 The Action Team**

To support and sustain efforts towards the promotion of healthy living, Action Teams were created in each school. These teams were comprised of teachers, resource staff, administrators and Parent Advisory Committee members, and ranged in size from four to eighteen members. Action Teams were responsible for completing an annual school Action Plan, based on the six Action Zones, and reporting progress to the *Action Schools! BC Support Team*.<sup>a</sup>

Each Action Team from participating schools selected their Whole School and Classroom physical activities from a matrix of choices designed to deliver a minimum of 150 minutes of physical activity per week. Once the Action Teams developed their Action Plan, relevant materials (both hard copy and web-based) and equipment were provided to fill gaps in existing resources.

### **3.2.3 The Action Plan**

Each school completed an annual Action Plan that served as a planning tool for physical activity and healthy eating initiatives. The Action Plan required the Action Teams to set goals in each Action Zone and identify steps to accomplish them. Goals and actions could be related to maintaining programs already in place, building on existing goals set by the School Planning Committee, or initiating new programs based on ideas provided or suggestions from students, staff members, parents or community practitioners. The *Action Schools! BC Support Team* was available to help Action Teams develop their Action Plans.

### **3.2.4 Whole School Action**

The *Action Schools! BC* intervention focused on grades four through seven; however, action in the School Environment, Extra-Curricular, and School Spirit Action Zones contributed to an integration of physical activity and healthy living messages in the

---

<sup>a</sup> The central support team that provided support to the Action Teams.

whole school. Information about *Action Schools! BC* was shared at school assemblies, in the school newsletter, and at some schools, through bulletin boards designated for the initiative. *Action Schools! BC* activities such as a Sneaker Club filled the classrooms and hallways of participating schools with colourful visual representations of the students' logged physical activity. The organization of whole school activities, such as the Terry Fox Run and Jump Rope for Heart, further contributed to activating the whole school.

### **3.2.5 Classroom Action**

The *Action Schools! BC* framework for action supports the curriculum goal of providing 150 minutes of scheduled physical education per week. Based on findings that reported that most B.C. students received only 80 minutes of physical education per week, activities in the Classroom Action Zone were developed to provide teachers with creative, alternative physical activity ideas that complement scheduled physical education and support the achievement of the curriculum goal. Activities can be implemented in the classroom, a multipurpose room, or on the playground. Activities were selected to contribute to outcomes in each of the health targets, and included: Bounce-at-the-Bell, gripper and exercise band routines, playground exercise circuits, and chair aerobics. Classroom Action was supported by the provision of Action Bins to pilot grades in each school and participating teachers were asked to track their classroom action minutes and activities in weekly logs that were submitted to the *Action Schools! BC* Support Team for evaluation (see Teacher Training and Resources, below).

### **3.2.6 Healthy Eating - The 5-TODAY Model**

Children are susceptible to many outside influences that often deliver conflicting messages about nutrition and promote the consumption of junk foods or ways of eating. Although fruits and vegetables have been shown to reduce the risk of some chronic diseases, 61 per cent of children ages 12 to 18 years in BC do not eat the minimum recommendation of five servings of vegetables and fruit per day<sup>27</sup>. For the Healthy Eating component of the *Action Schools! BC* model, the Action Schools! BC Support Team developed the 5-TODAY Model, which teaches children the benefits of eating at least five servings of fruits and vegetables per day, as recommended by Canada's Food Guide to Healthy Eating. The 5-TODAY Model delivered a simple, positive and accessible message to eat five fruits or vegetables every day.

The Healthy Eating component was delivered in the Classroom Action Zone of the *Action Schools! BC* model. It was developed based on best practices from similar school fruit and vegetable interventions in the United States. Grades five and six teachers in *Action Schools! BC* Liaison and Champion schools taught students about fruit and vegetables using 5-TODAY lesson plans and resources provided by the *Action Schools! BC* Support Team. Teachers were required to deliver two lesson plans during the school

year, followed by the 5-TODAY Challenge, which encouraged students to eat at least five fruits and vegetables per day for a week.

### 3.2.7 Teacher Training and Resources

One of the primary intentions of *Action Schools! BC* was to increase capacity to integrate healthy living into the fabric of the school community. The creation of quality support resources and the provision of teacher training were key considerations when developing the intervention and the sustainability plan.

The *Action Schools! BC* Planning Guide for Schools and Teachers and the Classroom Action Resource Guide were created to provide schools with templates, curriculum connections, implementation tips and action ideas. Action Bins, filled with playground balls, skipping ropes, exercise bands, strength grippers, and teaching resources, were distributed to each school (one for each pilot classroom). Inventories of current school action, equipment, human and community resources, available teaching resources, and school health policies and practices were undertaken to increase awareness among school Action Teams and to provide baseline information to the *Action Schools! BC* Evaluation Team.<sup>b</sup>

The *Action Pages!*<sup>c</sup> provided information about recommended resources and additional programs and initiatives from across Canada to support new goals and programs that schools identified as part of their Action Plans. The *Action Schools! BC* website ([www.actionschoolsbc.ca](http://www.actionschoolsbc.ca)) was created to host information about the intervention and research programs, downloadable planning templates and resources, media coverage and promotional pieces, and links to other physical education and activity resources, programs and initiatives.

The *Action Schools! BC* Support Team provided a variety of support and teacher training to participating schools. Information meetings were held at each school to educate them about *Action Schools! BC*. The *Action Schools! BC* Support Team met with each Action Team to review the *Action Schools! BC* Planning Guide for Schools and Teachers and the Classroom Action Resource Guide and support the creation of their Action Plan and the completion of their inventories. Interim and year-end meetings were organized for progress reports, feedback and to initiate planning for the subsequent year. Action Teams were encouraged to contact the Support Team if they had any questions or concerns, or needed additional assistance.

The Support Team also assisted with the organization of additional workshops and presentations by provincial sport organizations (e.g. the Premier's Sport Awards

---

<sup>b</sup> The research team that conducted the measurement and evaluation of the AS! BC pilot project.

<sup>c</sup> Contains comprehensive lists of physical activity and healthy eating resources to support the Action Plan

Program, Esteem Team, BC Wheelchair Sports, Tennis BC), and connected schools with community organizations to expand the type of physical activity opportunities offered (e.g. partnering with local community centres for swimming and skating programs). To further increase awareness and support for the province-wide implementation of *Action Schools! BC!*, the *Action Schools! BC* Support Team made presentations to Parent Advisory Committees, principals, school districts, and community recreation and health practitioners.

Two Master Trainers were hired to support the schools in completing their inventories and implementing their Action Plans. Support included site visits to demonstrate classroom activities and professional development workshops on a variety of topics, including dance, exercise bands, and playground games.

### **3.2.8 The School Community**

The success of the *Action Schools! BC* model lies in the ownership of the initiative by the school community. To encourage the involvement of the children, teacher, administrators and parents, members of the larger school community participated in a variety of activities ranging from the conventional (walking, running, sports) to the unconventional (skate boarding, hip hop dancing, wall climbing).

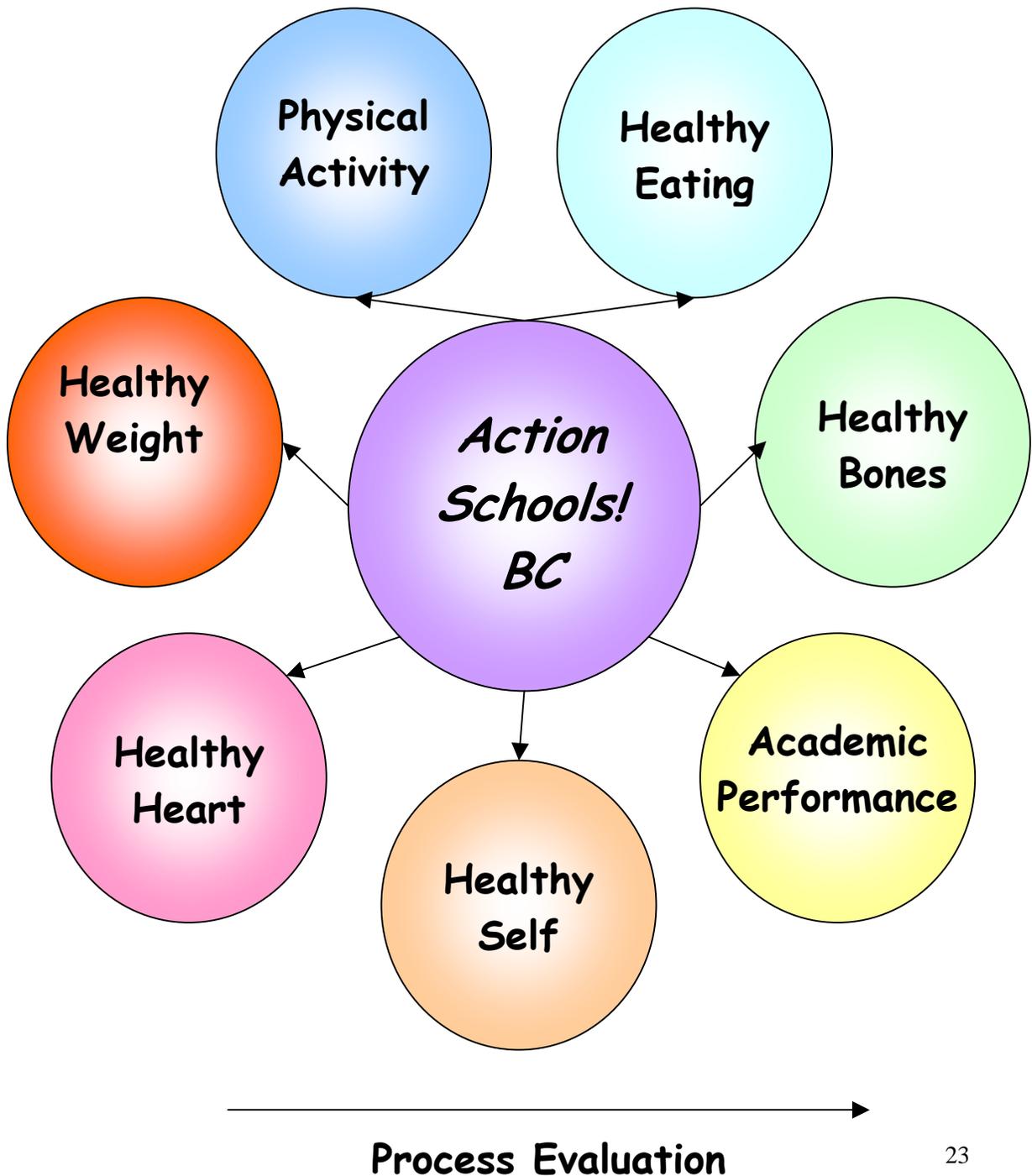
### **3.2.9 The Larger Community**

*Action Schools! BC* partnered with BC Recreation and Parks Association, Richmond Leisure Services and the Vancouver Board of Parks and Recreation to enhance opportunities for children to participate in a wide variety of physical activities. *Action Schools! BC* also linked with individuals and organizations (e.g.: community coaches, local clubs, provincial sport and multi-sport organizations) in the pilot school communities to further enhance health-related opportunities. *Action Schools! BC* also engaged Regional Health Authorities and physicians groups and organizations (BC College of Family Physicians and BC Pediatrics Society), which have become advocates for the *Action Schools! BC* model.

#### 4. The Evaluation

The purpose of the evaluation was to determine the effectiveness of the *Action Schools! BC* Model for improving the levels of physical activity and healthy eating education in the school environment and the subsequent effect, if any, on a number of chronic disease risk factors, psychosocial health and academic performance. Figure 4.1 illustrates the seven key outcomes evaluated in *Action Schools! BC* Phase I.

Figure 4.1. Outcomes evaluated in *Action Schools! BC* – Phase I.



## 4.1 Who Was Evaluated?

Students participated in the comprehensive evaluation. Teachers, administrators and parents participated in classroom logging and/or the focus groups and interviews associated with the process evaluation.

### 4.1.1 School and Student Recruitment

A formal partnership was established between the UBC Faculty of Education and the Vancouver School Board that allowed Board-approved projects to be evaluated in Vancouver Schools. A letter of consent from the Superintendents of the Vancouver and Richmond School Districts was obtained to conduct the pilot project in their school districts.

Building on relationships established in the Richmond School District during previous school-based interventions conducted in 1997 and 2001 and between the Premier's Sport Awards Program and BC elementary schools over the past 20 years, the Principal Investigator (Dr. Heather McKay) and the Program Team Manager (Bryna Kopelow) presented the *Action Schools! BC* model to Principals and Vice-Principals in November 2002. Following the presentations, three schools in the Richmond District and seventeen schools in the Vancouver District volunteered to participate in the *Action Schools! BC* pilot. Final intervention participants were selected based on results from the 2002 B.C. Ministry of Education Satisfaction Survey, in which students and parents were asked to rate their physical activity experience or that of their child on a scale ranging from one (not satisfied) to five (very satisfied). Eleven schools were selected based on the majority of students and parents surveyed having chosen two or three on the five-point scale. Of those eleven schools, one decided not to continue with the pilot due to scheduling constraints, bringing the total to ten participant schools.

Initial meetings were held with each school in December 2002 and January 2003, where the *Action Schools! BC* team presented the pilot timeline and outlined the responsibilities of the teachers and school administrators. Subsequently, an overview of the initiative was presented to grade four and five students in each school. The *Action Schools! BC* Support Team outlined the highlights of the project and encouraged participation. Consent forms were sent to parents in four languages (English, Chinese, Vietnamese and Punjabi), reflecting the ethnic diversity of the participating schools. Five hundred eighty-five signed consent forms were returned by parents or guardians. Of these, 515 children were eligible to participate in the *Action Schools! BC* evaluation. Descriptive characteristics for these children at baseline are provided (Table 4.1).

**Table 4.1. Description of the children who were measured as a part of the *Action Schools! BC* evaluation at baseline (n = 515).**

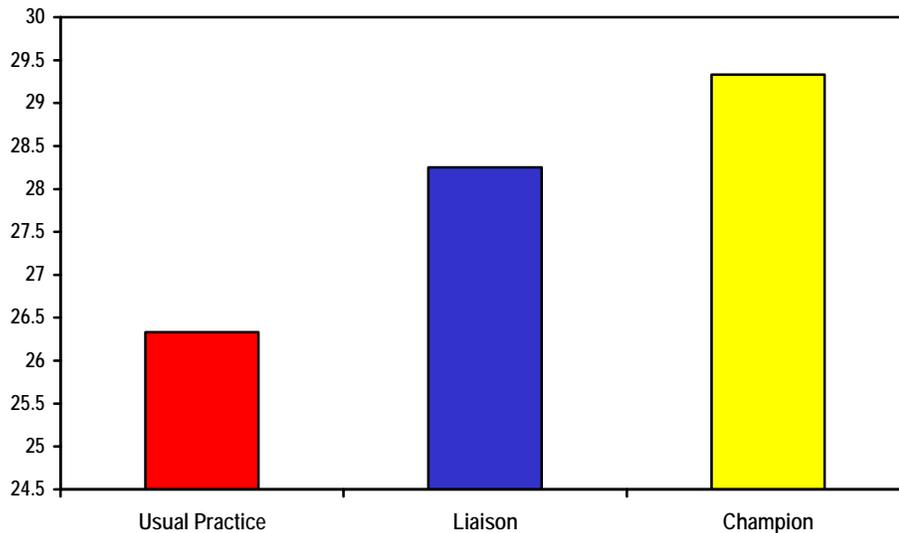
	<b>Girls n = 259</b>	<b>Boys n = 256</b>
<b>Age (years)</b>	10.2 (0.6)	10.2 (0.6)
<b>Height (cm)</b>	141.2 (7.5)	141.3 (7.1)
<b>Weight (kg)</b>	36.3 (8.4)	38.0 (9.6)
<b>Body Mass Index (BMI, kg/m<sup>2</sup>)</b>	18.1 (3.0)	18.8 (3.6)

#### **4.1.2 Socio-economic Status of Target School Districts**

Socioeconomic status information was obtained from the 2001-2002 District Reports published on the Ministry of Education’s website. Data are from Statistics Canada’s 2001 Canadian Census<sup>28</sup> and is measured as the dollar amount that marks the midpoint of a distribution of families with income ranked by size of income. No socio-economic data were collected or analysed by *Action Schools! BC*.

The districts in Vancouver and Richmond from which the *Action Schools! BC* children were drawn represented a wide socioeconomic strata. The average family incomes in the Richmond (\$52 524) and Vancouver (\$51 780) school districts are below both the provincial and national averages (\$54 840 and \$55 016, respectively). Twenty six per cent of families in Richmond and 26.9 per cent of families in Vancouver have incomes that are below \$30 000 per year.<sup>29</sup> The socioeconomic status of families living in Vancouver and Richmond School Districts are provided (Figure 4.2).

**Figure 4.2. Socio-economic status of families in *Action Schools! BC* Schools in the Vancouver & Richmond School Districts. Represents per cent of schools in districts where families receive annual tax income below \$30,000 (2002/03) by group.**



### 4.1.3 Ethnicity of Target School Districts

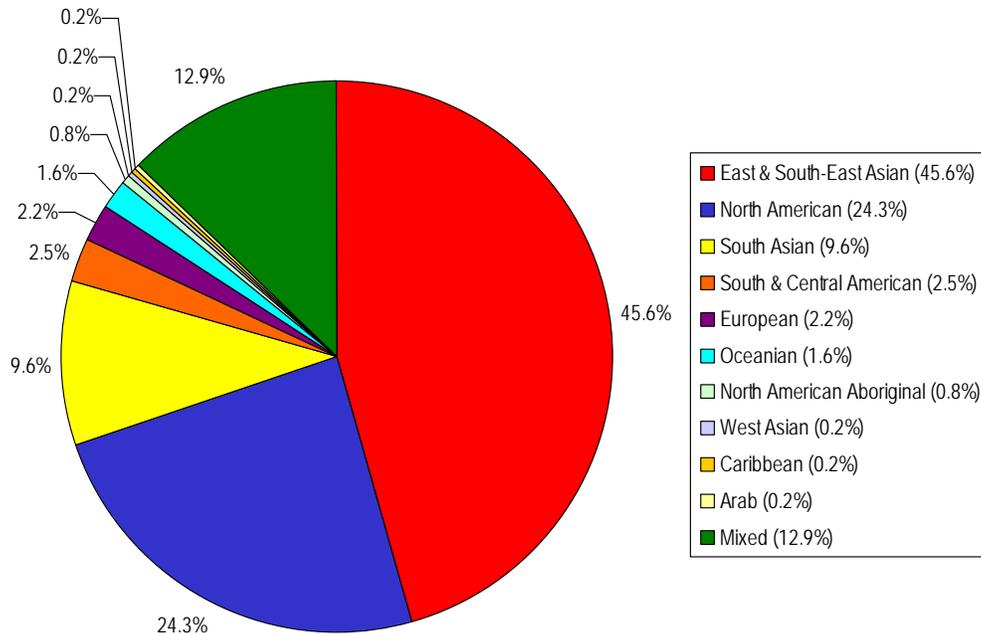
2001 Canadian Census Data<sup>30</sup> for the Municipality of Richmond and for Greater Vancouver was used to determine the over-all ethnic make-up of the regions. In order to determine the ethnicity of the *Action Schools! BC* participants, parents were asked to classify their own and their child's ethnicity on a Health History Questionnaire they completed for their child. Children were asked to identify the language(s) spoken at home and the birthplace of their parents.

The *Action Schools! BC* children were an ethnically diverse group. The participants identified themselves as: 45.6 per cent East and South-East Asian, 24.3 per cent North American, 9.6 per cent South Asian, 12.9 per cent Mixed and 7.7 per cent other (including: South and Central American, European, Oceania, North American Aboriginal, West Asian, Caribbean and Arab) (Figure 4.3)

This is a good representation of the Greater Vancouver area as overall, 37 per cent of Vancouver residents and 59 per cent of Richmond residents reported being a member of a visible minority and 35 per cent of Richmond residents and 25 per cent of Vancouver residents reporting Chinese (Mandarin, Cantonese and Hakka) as their first language.<sup>31</sup> British Columbia has the highest proportion of visible minorities in Canada (Figure

5.3),<sup>32</sup> and the *Action Schools! BC* cohort have a higher proportion of East and South-East Asian and European families and a slightly lower proportion of South Asian families than both the provincial and national populations (Figure 4.3).<sup>33</sup>

**Figure 4.3. Ethnic origins of *Action Schools! BC* participants.**



#### 4.1.4 Study Design

Phase I of *Action Schools! BC* was conducted over seventeen months from February 2003 to June 2004. Schools were stratified based on size, geographic location and ethnicity and randomly assigned to one of three groups:

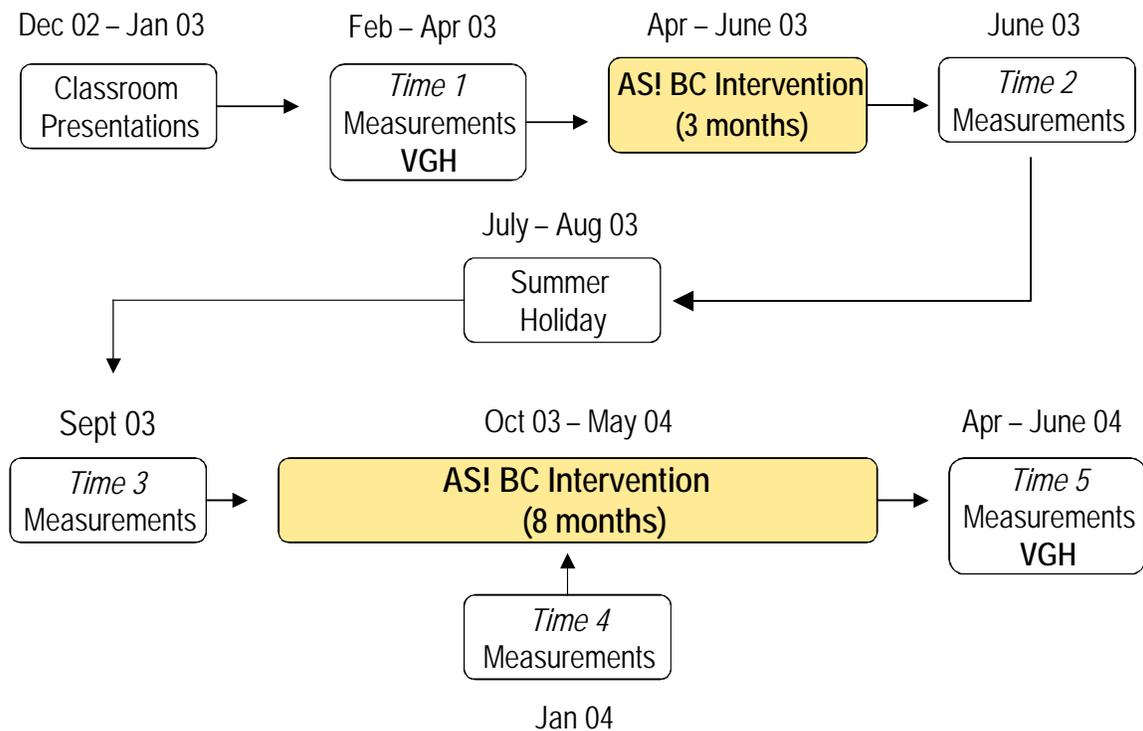
- *Usual Practice Schools* (3 total): Continued their usual physical activity and health programs without intervention from the *Action Schools! BC* team.
- *Liaison Schools* (4 total): *Action Schools! BC* provided a dedicated Master Trainer and all required resources to administer the *Action Schools! BC* model.
- *Champion Schools* (3 total): *Action Schools! BC* provided a contact person who supported a champion or champions designated from within the school community.

The numbers of participants at each evaluation period (Table 4.2) and the timeline (Figure 4.4) of the *Action Schools! BC* pilot is provided.

**Table 4.2.** Number of *Action Schools! BC* participants by evaluation time (T) period. The shaded rows indicate the number of participants in the baseline and final measurements.

<b>Intervention Group</b>	<b># of Schools</b>	<b>T1</b>	<b>T2</b>	<b>T3</b>	<b>T4</b>	<b>T5</b>
Usual Practice	3	156	156	139	134	135
Liaison	4	188	187	174	170	170
Champion	3	171	167	149	146	140
<b>Totals</b>	<b>10</b>	<b>515</b>	<b>510</b>	<b>462</b>	<b>450</b>	<b>445</b>

**Figure 4.4.** *Action Schools! BC* study timeline.



## 4.2 What Was Evaluated?

### 4.2.1 Measurement

#### Measurement at the UBC Bone Health Research Laboratory (VGH)

Student participants, (supervised by a driver and a chaperone) in groups of five or six, were excused from school for five two-hour assessment periods during the project and transported to the UBC Bone Health Research Laboratory at the Vancouver General Hospital Research Pavilion. Baseline and final measurements of physical activity, dietary intake, psychosocial health (by questionnaire) and anthropometry, physical performance and bone health were conducted.

#### Measurement in the Schools

The *Action Schools! BC* Evaluation Team also conducted on-site measurements in the schools five times during the pilot project (February 2003 - Baseline, June 2003, September 2004, January 2004, March 2004 and June 2004 - Final). Cardiovascular fitness was assessed and questionnaires (as above) were administered.

### 4.2.2 Anthropometry

Body mass (kg), stature (sitting and standing height without shoes and stretch statures for both in cm) and waist circumference (cm) was measured using standard techniques.

### 4.2.3 Physical Activity and Performance

*The Province of B.C. has accepted the Canadian Medical Association's challenge to increase physical activity by 10 per cent and is aiming to exceed that goal to 20 per cent by the year 2010.*

Physical activity level was assessed with the Physical Activity Questionnaire for Children (PAQ-C) at baseline, final and three additional times during the school year. The PAQ-C was designed to measure general habitual physical activity in a moderate to vigorous range. General physical activity (min/day) was determined from the PAQ-C.

Each child was also given a pedometer at the start and near the end of the trial period to assess the number of steps taken over the course of one week. The children wore pedometers at their waist and in line with the thigh all day for seven days. At the end of the week pedometers were collected and weekly steps recorded.

## 4.2.4 Healthy Hearts

### Physical Activity and Cardiovascular Disease

Physical activity increases the functional capacity of the heart and plays a major role in preventing many cardiovascular-related risk factors such as obesity, hypertension and blood cholesterol. As levels of many risk factors, including obesity, cholesterol and blood pressure are often established in childhood and continue into adulthood, it is extremely important to identify those individuals with elevated levels before damage to the cardiovascular system occurs.<sup>34 35</sup>

### Cardiovascular Disease Risk Factors

The *Action Schools! BC* team assessed a total of twelve CVD risk factors. Commonly studied CVD risk factors such as body weight, BMI and blood pressure were measured. A small subset of seventy children received parental consent to have blood drawn to assess other common CVD risk factors such as HDL and LDL cholesterol and triglycerides. In addition we assessed risk factors not often measured in previous studies, including homocysteine, C-reactive protein, and fibrinogen.

### Blood Pressure and Arterial Compliance

Maintaining a healthy blood pressure in childhood is vital, as levels are known to track from childhood into adolescence and adulthood.<sup>36 37</sup> Blood pressure was measured twice on each child, after five minutes of quiet sitting, using an automatic sphygmomanometer.

Arterial compliance has been shown to be an indicator of vascular health. Changes in arterial compliance precede, by years, clinical evidence of chronic disease<sup>38</sup>, making it an important early predictor of the risk for adult diabetes, hypertension and CVD.<sup>39</sup> Arterial compliance was measured using a tonometer, a non-invasive pressure device placed on the right arm at the level of the wrist, which determines change in pressure in relation to change in volume of the blood vessel. Use of this novel measure has not previously been conducted in children.

### Cardiovascular Fitness

Cardiovascular fitness was measured using evaluation methods that focus on health-related fitness as opposed to performance-related fitness. Aerobic fitness was measured using Legers 20m shuttle run, a maximal progressive test designed for children.<sup>40</sup>

## 4.2.5 Healthy Weight

The percentage of children and adolescents who are defined as overweight has more than doubled in Canada since the 1980s. Overweight refers to increased body weight in relation to height. It is important to note that overweight may or may not be due to increased body fat. Overweight may also represent an increase in lean mass especially in

those children who participate in high level, high intensity sport (such as gymnastics). We used body mass index (BMI) as an index of overweight or obesity as BMI is highly associated with body fat and has have been linked to overall health risk in adults. Based on NIH clinical guidelines adults with a BMI >25 are considered at risk for premature death and disability. We acknowledge that BMI may misrepresent health risk in a small number of high active, highly muscular children. We calculated Body Mass Index (BMI, kg/m<sup>2</sup>) as the ratio of body weight to height using anthropometry assessments collected in September 2003 and June 2004. Children with a BMI of 25 to 29.9 were considered overweight and children with a BMI of 30 or higher were considered obese. Risk has also been assessed in children by classifying children with BMI-for-age in the 85<sup>th</sup>-95<sup>th</sup> percentile and at risk for overweight and those with BMI-for- age > 95<sup>th</sup> percentile considered overweight.

We also derived body fat directly from the total body densitometry scan (see Healthy Bones). Children aged four to eleven years with a per cent body fat greater than 33 per cent are fifteen times more likely to have an adverse CVD risk factor profile,<sup>41</sup> and were therefore classified as High Risk.

#### **4.2.6 Healthy Eating**

We administered a food frequency questionnaire (FFQ) to assess dietary intake of calcium. The FFQ was adapted from a questionnaire validated in Asian and Caucasian adolescents living in Vancouver. Children completed the questionnaire in small groups (maximum 3) facilitated by a research assistant. Certain cues are used to assist children in food frequency recall, such as “Do you eat this food every morning?” or “How many times since school began this year did you eat this food?” A bilingual (Chinese-English) measurer was available to assist Chinese children. Pictures of food items in appropriate serving sizes were mounted on the laboratory walls. In comparison to food records, this questionnaire has a low respondent burden and is relatively easily administered to children. Questionnaires were analyzed by calculating a daily calcium intake (mg) based on the calcium content of food items.

In our previous study, the reliability (intraclass correlation coefficient) of the average of 3 assessments (Fall, Winter, Spring) during Year 1 had a reliability of alpha=0.71 in boys and alpha=0.77 in girls. We determined the percentage of boys and girls who met the Dietary Reference Intake for calcium of 1300mg/day for children 9-18 years [DRI is from the Canadian National Institute of Nutrition].

The effectiveness of the 5-TODAY Model was evaluated by changes in dietary intake of, and attitudes toward, fruit and vegetables over one school year (September 2003 through June 2004). The 5-TODAY model was assessed by 24-hour food recalls, a fruit and vegetable Food Frequency Questionnaire (FFQ), and a Fruit and Vegetable

Attitudes (FVA) survey. Fruit and vegetable servings were calculated from the 24-hour food recalls using Canada's Food Guide to Healthy Eating's serving sizes, which recommends five to ten servings of fruit and vegetables per day. The FFQs were used to calculate the average number of times fruit and vegetables were consumed per day. A research assistant administered all surveys orally to each student one-on-one. Qualitative teacher feedback was gathered in focus groups arranged during the June evaluation period.

#### **4.2.7 Healthy Bones**

It is increasingly well accepted that many of the antecedents of adult osteoporosis may already be present in childhood and that risk factors for adult osteoporosis such as a sedentary lifestyle track into adulthood. It has been shown that 25 per cent of adult bone mass is laid down during just two adolescent years.<sup>42</sup> To put this in perspective, this is as much bone mass as is lost in fifty years of adulthood. The ages of ten to twelve years provide a window of opportunity when growing bone appears to respond more positively to physical activity than any other time throughout a lifetime.<sup>43</sup>

Children's total body and hip bone mass (BM, grams) were measured twice in the UBC laboratory (February 2003 and June 2004) using bone densitometry. Total body lean and fat mass (per cent) was also assessed from the total body bone densitometry scan.

#### **4.2.8 Healthy Self**

Self-esteem and specific competencies are key indicators of a healthy self in children. Research has demonstrated that proficiency and general self-esteem can improve as a result of increased physical activity.<sup>44 45 46</sup> In the Healthy Self component of the *Action Schools! BC* pilot self-competence and self-esteem were assessed in both the UBC laboratory and in the schools. Participants completed Harter's perceived competence scale for children<sup>47</sup>, which measures athletic competence, social competence, academic competence and general self-esteem.

Motivation for leisure-time physical activity is a critical part of actual participation. Research has demonstrated that positive experiences in school contribute to voluntary involvement in physical activity during free time. We assessed physical activity motivation during the five evaluation periods using the theory of planned behaviour<sup>48</sup>, a well-validated model of human motivation. Measures of motivation in the theory of planned behaviour include: affective attitude (e.g.: enjoyment), instrumental attitude (e.g.: whether the behaviour is evaluated as important), subjective norm (e.g.: whether it is important that others approve of the behaviour), descriptive norm (e.g.: whether it is important that others do the behaviour), perceived behavioural control (e.g.: whether

the individual has the skills, opportunity and resources to do the behaviour), and behavioural intention to engage in the physical activity.

#### **4.2.9 Academic Performance**

Previous studies show a positive relationship between physical activity and academic performance<sup>49</sup> and that physical activity is important for the development of basic motor skills necessary for academic achievement in children.<sup>50</sup> *Action Schools! BC* participants were administered grade-specific CAT tests in both June 2003 and in June 2004. The CAT is a standardized test that is validated for use across all grades with sections on reading, math and language. Tests were in a scantron (bubble) answer sheet format and the time allotted for the test was 110 minutes.

#### **4.2.10 Process Evaluation**

The Process Evaluation was undertaken to assess the facilitators and barriers, unexpected positive and negative impacts and the satisfaction level of major stakeholders for implementation of the *Action Schools! BC* Model.

Quantitative data were collected from the Training Evaluations, Action Plans and Weekly Activity Logs, in which teachers recorded all physical activities undertaken before, during and after school including school programs such as the *Sneaker Club* and the *Walking School Bus* (in which a parent or teacher acted as the school bus, collecting all students living in a close neighbourhood and walking them to school). Attendance records were collected to ascertain when students were unable to participate in school activities due to absence.

Qualitative data were gathered through focus groups with teachers, administrators, parents, students and advisory committees, from minutes of the school advisory committee, and from monthly facilitator interviews and semi-structured interviews with school administrators, teachers, parents and student participants. Media analysis was done to evaluate the wider impact of the model and the effectiveness of the delivery of the *Action Schools! BC* message.

## 5. The Results - What Did We Find?

### 5.1 Physical Activity

*Research Question: Was participation in Action Schools! BC an effective means to increase the physical activity behaviours of children?*

*How physically active were the children at the beginning of the study?*

The amount of minutes per day of general physical activity the children were engaged in (Table 5.1), steps taken per day (Table 5.2) and a description of the percentage of children involved in organized sport and the hours per day they spent watching television at baseline is provided (Table 5.3).

**Table 5.1. Mean minutes of general physical activity undertaken per day at baseline by Action Schools! BC participants in low, medium and high physical activity level groups by sex and intervention group.**

	Usual Practice Boys	Liaison Boys	Champion Boys	Usual Practice Girls	Liaison Girls	Champion Girls
<b>Low Active (&lt;30 min/day)</b>	13 (8)	19 (8)	19 (10)	19 (8)	19 (9)	19 (8)
<b>Medium Active (30-60 min/day)</b>	47 (9.1)	44 (8)	48 (10)	44 (8)	42 (8)	46 (9)
<b>High Active (&gt;60min/day)</b>	119 (39)	110 (36)	113 (38)	110 (36)	97 (34)	103 (35)
<b>All Activity Levels</b>	95 (58)	79 (58)	105 (71)	93 (67)	64 (58)	81 (54)

**Table 5.2. Steps taken per day at baseline by *Action Schools! BC* participants in low, medium and high physical activity level groups by sex and intervention group.**

	Usual Practice Boys	Liaison Boys	Champion Boys	Usual Practice Girls	Liaison Girls	Champion Girls
<b>All Activity Levels</b>	10189 (3639)	10723 (3828)	11462 (4335)	10506 (3846)	9430 (2708)	10278 (3198)

**Table 5.3. Description of *Action Schools! BC* children involved in organized sport and the TV viewing habits of the children by sex at baseline (n = 515).**

	Girls (n = 257)	Boys (n = 258)
<b>Percentage of children who participate in organized sport</b>	51 per cent	55 per cent
<b>TV time (hr/day)</b>	2.3 (1.2)	2.5 (1.2)

Despite randomization, there was a difference in the physical activity level of girls between school groups at baseline. This was reflected in the physical activity level of girls in the Usual Practice group who were more active than girls in the Liaison and Champion groups. Girls in Usual Practice schools participated in approximately 29 more minutes per day of moderate to vigorous physical activity than girls in Liaison schools.

At baseline, boys in the Usual Practice and Champion schools were more active than boys in Liaison schools. Boys in Usual Practice and Champion schools participated in approximately 22 more minutes per day of moderate to vigorous physical activity than boys in Liaison schools.

From the PAQ-C, boys were significantly more physically active than girls, participating in approximately 13 more minutes of moderate to vigorous physical activity (MVPA) per day. From pedometer counts, boys took significantly more steps per day (8 per cent), on average, compared with girls.

***How physically active were the children at the end of the study?***

Results varied somewhat depending on whether we assessed physical activity behaviours of the children by questionnaire or by pedometer counts. As the questionnaires targeted physical activity undertaken primarily within the school

environment and pedometers assessed physical activity in and outside of school, this is not surprising. The results for each are presented.

***Action Schools! BC girls had an almost two times greater increase in physical activity compared with girls in control schools.***

***The percentage of low active children decreased 9 per cent in the Action Schools! BC schools and increased by almost 3 per cent in control schools.***

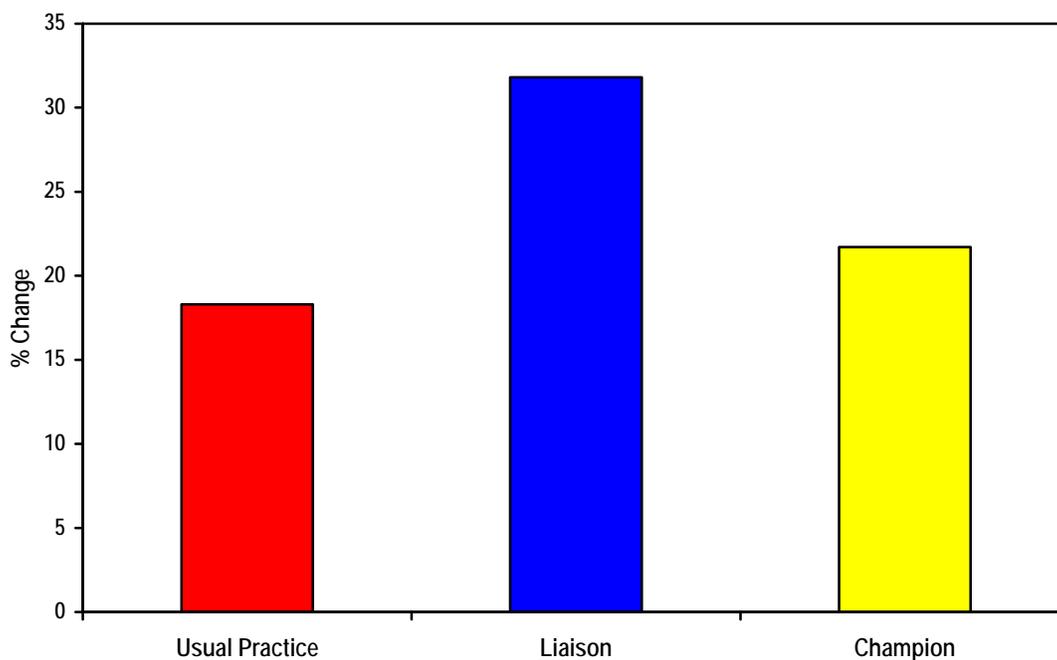
***Action Schools! BC teachers increased the amount of PA delivered to their students by 50 per cent in the Champion Schools and 100 per cent in the Liaison Schools. There was no change in the Usual Practice Schools.***

#### **Questionnaire – PAQ-C**

Overall, *Action Schools! BC* had the greatest positive influence on the physical activity level of students in the Liaison schools although this varied somewhat between boys and girls (Figure 5.1). As our Usual Practice schools were by chance already active schools we saw an increase in physical activity of about 25 per cent in both Usual Practice and the Champion schools, compared with an almost 33 per cent increase in the Liaison schools.

Although results were not significant, there was a trend for boys in the Liaison and Champion schools to increase the number of minutes per day of moderate to vigorous physical activity (MVPA) more than boys in the Usual Practice schools (98 and 52 per cent respectively, compared to 28 per cent). For girls, the greatest increase in physical activity was observed in those girls attending Liaison schools (32 per cent increase) compared with Champion (22 per cent) and Usual Practice (18 per cent) schools. Girls in Liaison schools had an almost two times greater increase in MVPA compared with girls in Usual Practice schools (Figure 5.1).

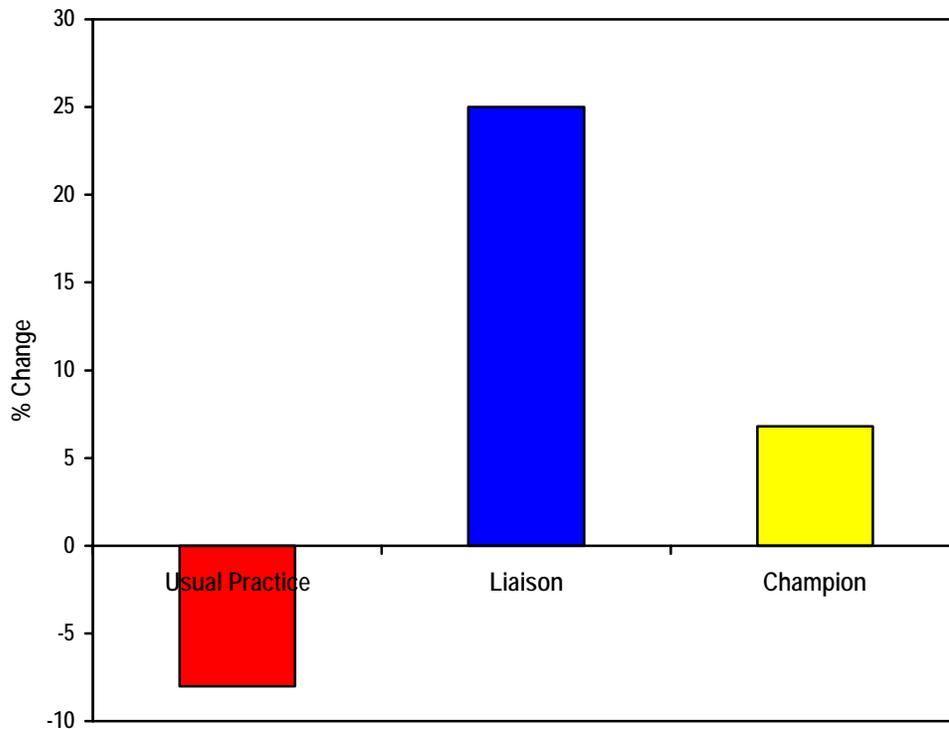
**Figure 5.1. Change (per cent) in physical activity for *Action Schools! BC* girls by intervention group across the study time period.**



***Pedometers***

The results from the pedometer measures, which assessed the number of steps children took over a seven-day period, showed *Action Schools! BC* had a positive (and statistically significant) effect on physical activity levels of children in both the Champion and Liaison schools compared with Usual Practice schools. Children in Liaison and Champion schools took significantly more steps per day than children in the Usual Practice schools. Girls in the Liaison schools increased their steps per day by 25 per cent, while girls in the Usual Practice schools decreased theirs by 8 per cent over the study time period (Figure 5.2).

**Figure 5.2. Change (per cent) in the average number of steps taken per day by Action Schools! BC girls across the study time period.**

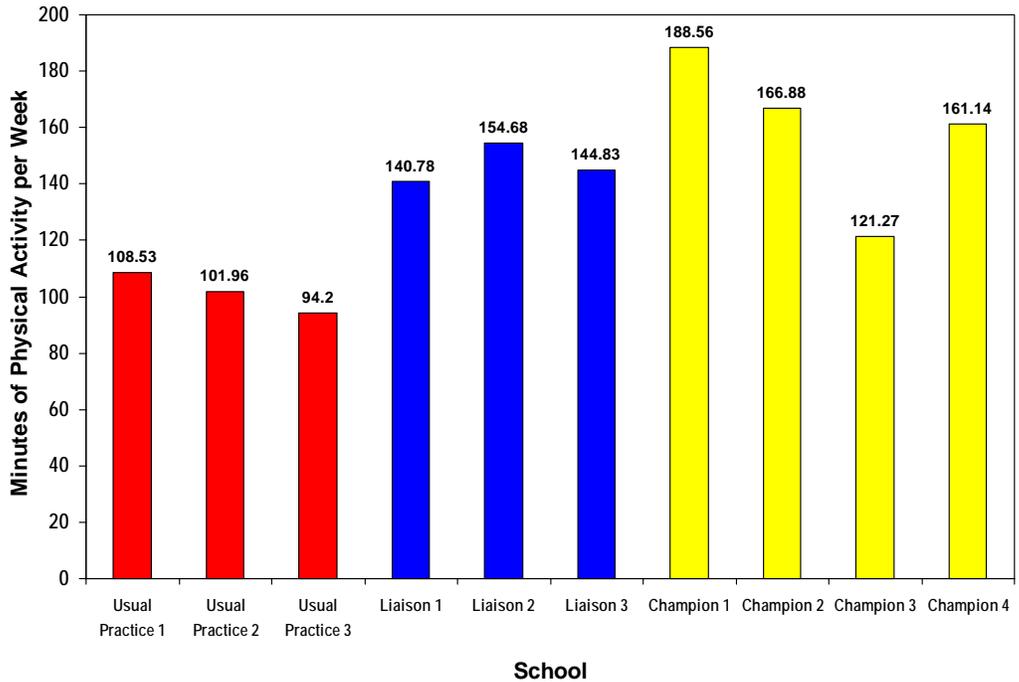


***Was more physical activity delivered through the Action Schools! BC Model?***

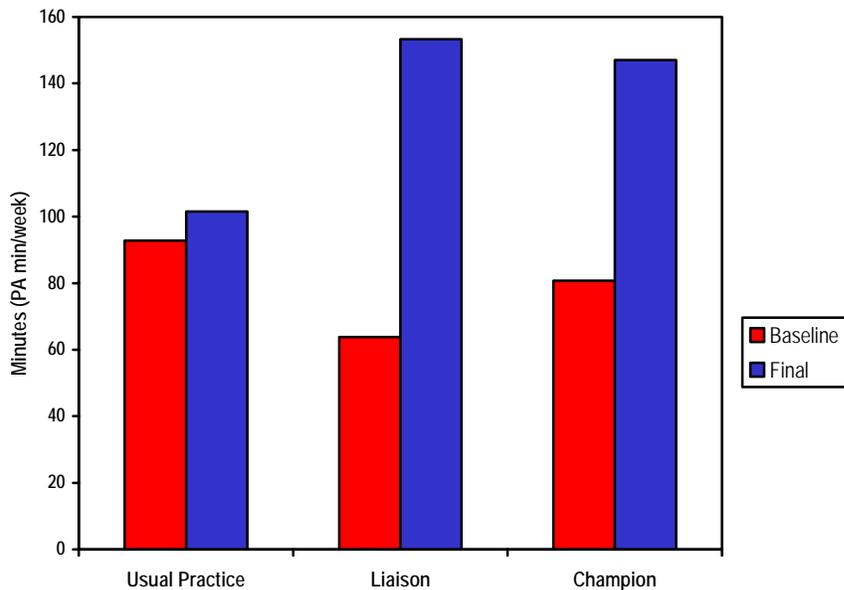
We also assessed the amount of physical activity delivered to children by their teachers during the school day. Importantly, the number of minutes of physical activity delivered by teachers increased 50 per cent in the Champion schools and more than doubled in the Liaison schools, whereas we observed no change in the Usual Practice schools (Figures 5.3 and 5.4). From the teachers' classroom logs we observed that teachers in Liaison and Champion schools provided 49 more minutes of physical activity per week, on average, as compared to the Usual Practice schools. The amount of physical activity delivered was significantly greater for both Action Schools! BC intervention schools compared with Usual Practice schools. There was no difference between the Liaison and Champion Schools for minutes of physical activity opportunities provided by teachers.

Figure 5.3 demonstrates that two teachers in the Champion schools were approaching their goal of 150 minutes of physical activity per week (mean = 143 min/wk) whereas 1 Champion school achieved this goal (156 min/wk). In the Liaison schools 3 of 4 schools were exceeding their goal of delivering 150 minutes of physical activity per week (mean = 172 min/wk). On average, teachers in Usual Practice schools delivered 102 minutes of physical activity/week to their students.

**Figure 5.3.** Minutes per week of physical activity delivered by *Action Schools! BC* teachers across all groups during the study time period.



**Figure 5.4.** Change in minutes per week of physical activity delivered by *Action Schools! BC* teachers across collapsed groups during the study time period.



## 5.2 Healthy Hearts

*The majority of children had at least one cardiovascular disease risk factor at the beginning of the Action Schools! BC study.*

*The most physically fit children had lower risk for cardiovascular disease than the least fit children.*

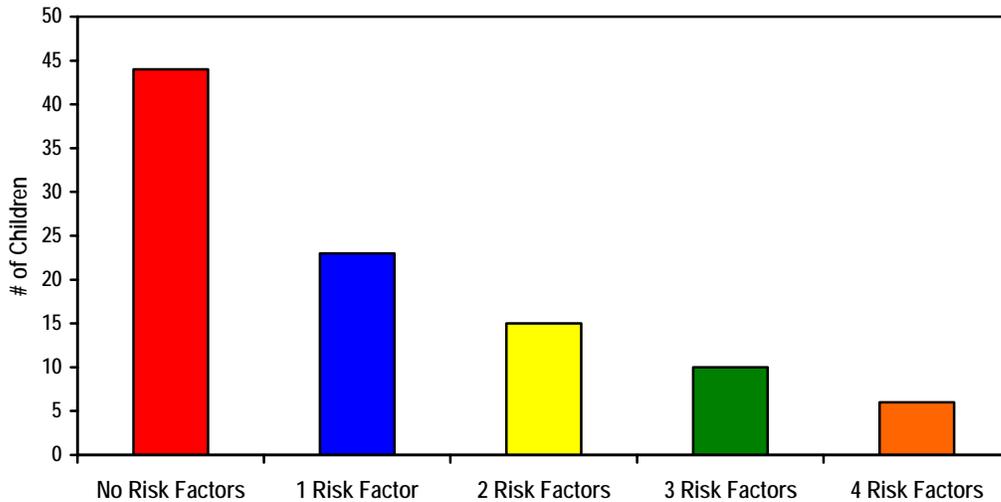
*Research Question: What is the relationship between physical activity and heart health in children?*

*What was the heart health profile of the children at the beginning of the study?*

Fifty-five per cent of children who provided blood samples had one or more CVD risk factors (Figure 5.4). This number is much higher than reported in previous investigations<sup>51</sup>. This may be explained by the fact that we assessed more CVD risk factors than in previous studies. Twenty three per cent of children had one elevated risk factor, 15 per cent had two elevated risk factors, 10 per cent had three elevated risk factors and 6 per cent had four elevated risk factors. There were few differences in mean values for CVD risk factors between girls and boys; however, a greater number of girls had values above the 85<sup>th</sup> percentile. These findings are cause for concern, as with few exceptions, we would not expect this prevalence of CVD risk for children of this age.

BMI was positively associated with many of the CVD risk factors. Children with a high BMI were more likely to have high blood pressure, high levels of cholesterol, triglycerides, C-reactive protein and fibrinogen. There was a negative association between levels of high-density lipoprotein (HDL, the “good cholesterol”) and BMI. That is, as BMI increased, HDL decreased. These findings reflect those most often reported for adults, whereby individuals with a high BMI frequently display several other CVD risk factors.

**Figure 5.4. Prevalence of cardiovascular disease risk factors in the study cohort. 55 per cent of the children displayed at least one risk factor.**

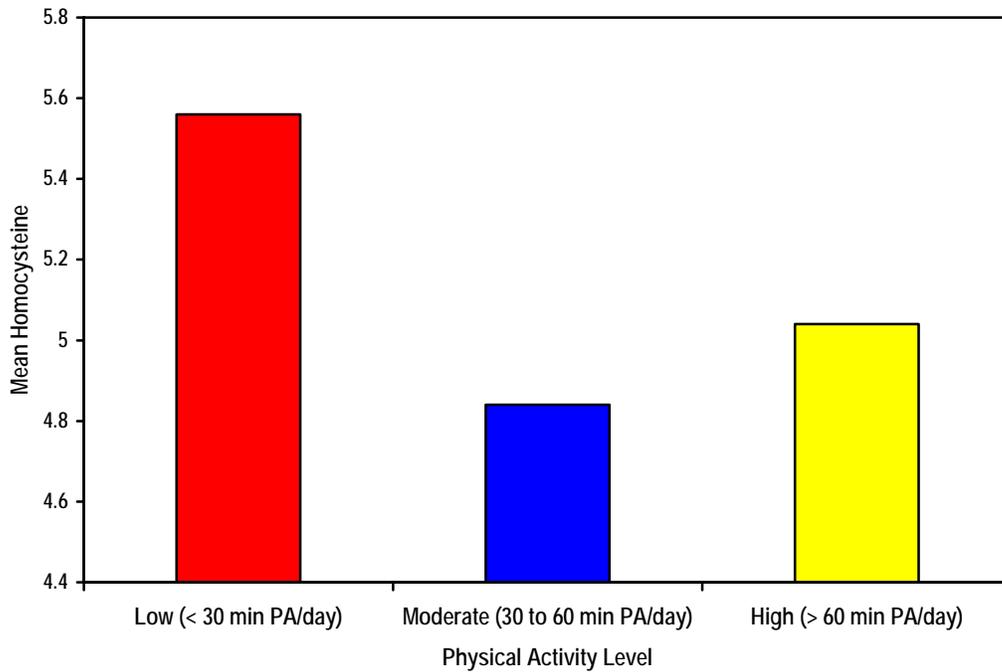


***What was the relationship between physical activity and CVD risk factors?***

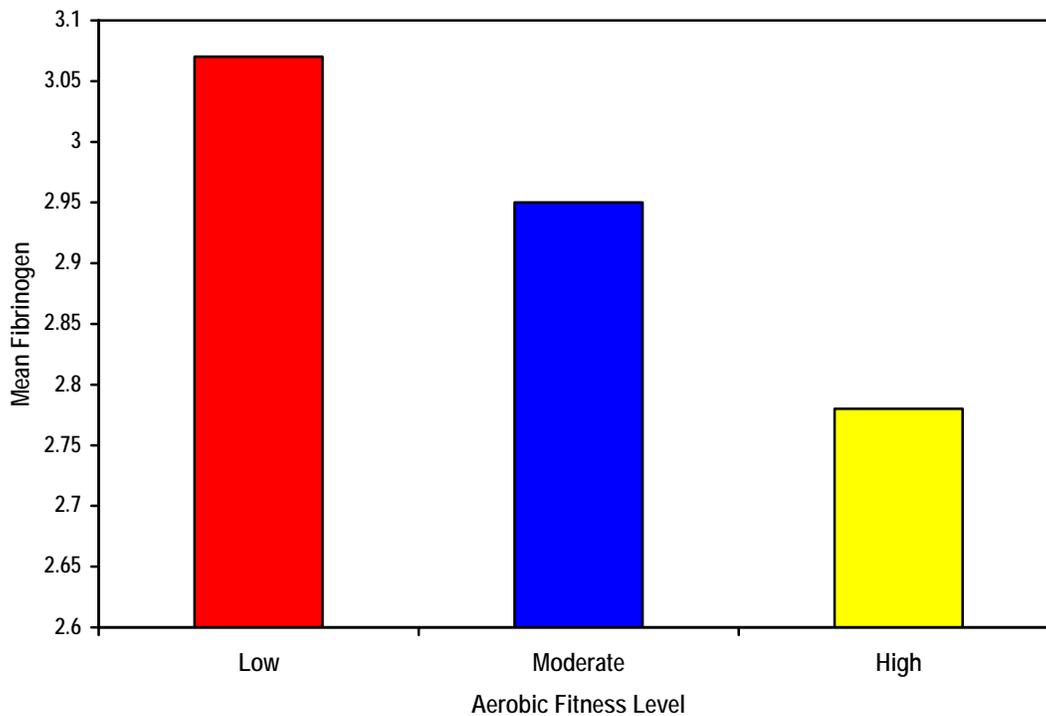
There were a number of interesting findings regarding the relationship between physical activity and CVD risk factors in children. Higher levels of physical activity were associated with several serum factors, including homocysteine, triglycerides, C-reactive protein and fibrinogen. Specifically, when the children were divided into low, medium and high physical activity groups based on physical activity level, children in the highest physical activity level group had statistically significantly lower homocysteine and triglyceride levels than children in the lower physical activity level groups. Triglyceride levels were highest for children in the low physical activity group. That is, more active children had more favourable serum profiles and lower values for those factors known to cause damage to blood vessels.

Figures 5.5 through 5.7 describe the CVD risk factors found in the *Action Schools! BC* participants by physical activity and aerobic fitness level. Children who were more active and physically fit had statistically significantly better heart health profiles than those who were inactive.

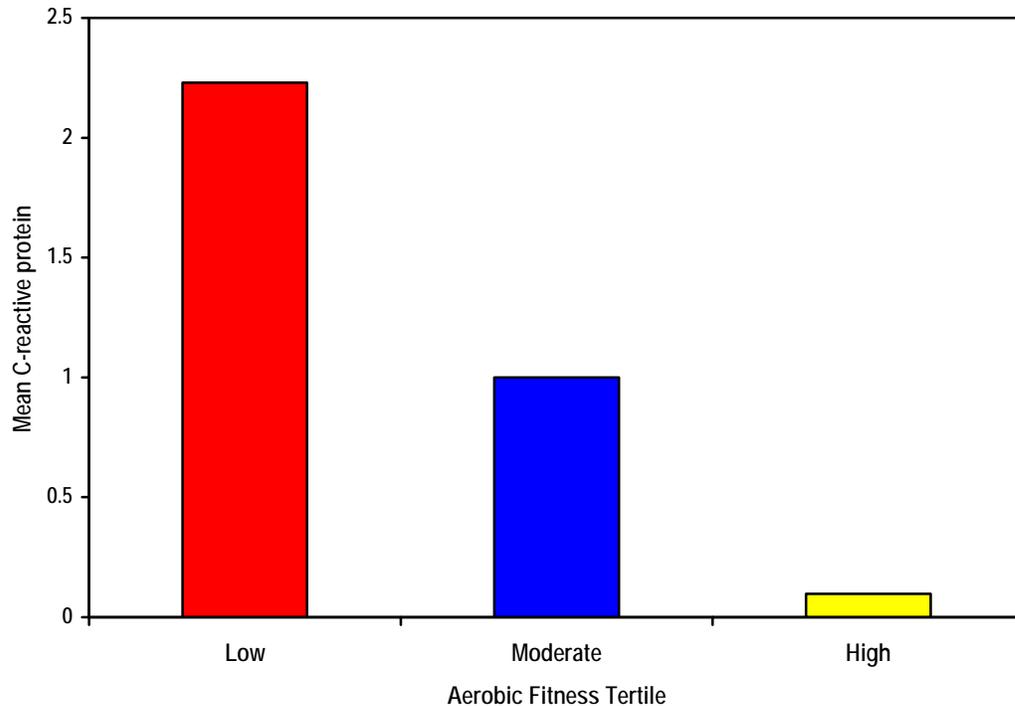
**Figure 5.5.** Mean homocysteine levels of *Action Schools! BC* participants divided into tertiles by physical activity level.



**Figure 5.6.** Mean fibrinogen levels of *Action Schools! BC* participants divided into tertiles by aerobic fitness level.



**Figure 5.7. Mean C-reactive protein levels of *Action Schools! BC* participants divided into tertiles by aerobic fitness level.**



### **Aerobic Fitness and Cardiovascular Disease Risk Factors**

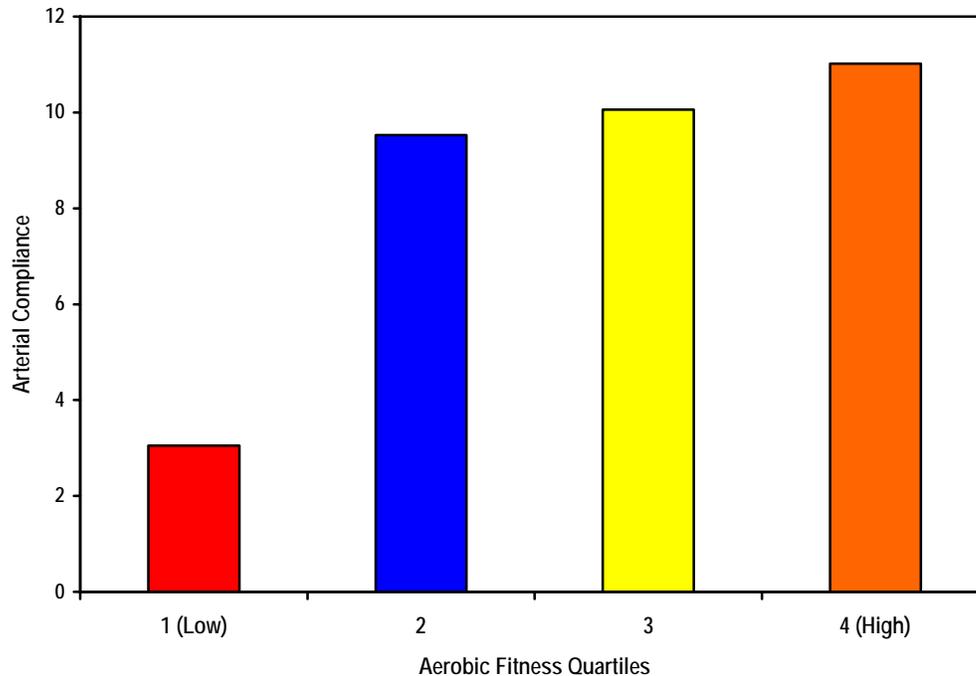
Children with high aerobic fitness had lower systolic blood pressure. We then divided participants into three groups according to aerobic performance and compared their serum levels. Children with the lowest aerobic fitness had higher levels of fibrinogen and C-reactive protein than children in the highest aerobic fitness group, putting them at higher risk for developing CVD.

### **Arterial Compliance**

Children who were the most fit had significantly more compliant arteries than those in the two lowest fitness level groups. There was a positive association between arterial compliance and aerobic fitness in children as young as nine years of age.

Figure 5.8 describes the arterial compliance of *Action Schools! BC* participants divided by physical activity level. Children who were more active had more compliant arteries than those who were the least active. Note that there is very little difference between children in the top three physical activity quartiles suggesting that a little exercise may make a large difference for child cardiovascular health.

**Figure 5.8. Mean arterial compliance in *Action Schools! BC* participants divided into quartiles by aerobic fitness level.**

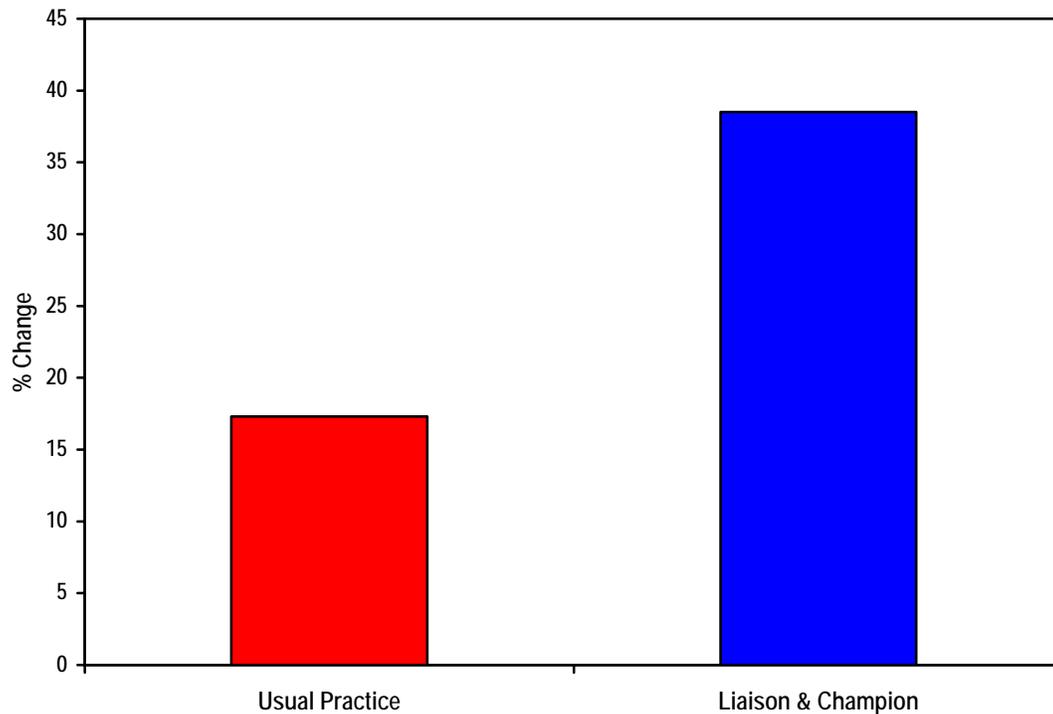


***What was the heart health profile of the children at the end of the study?***

When we compared baseline and follow-up results for the Leger’s 20m Shuttle Run which measured aerobic fitness, children in the Liaison and Champion schools increased their aerobic fitness by 39 per cent, significantly more than the children in the Usual Practice schools, who increased their aerobic fitness by only 17 per cent. Increased aerobic fitness levels in children contribute to CVD risk factor prevention. The *Action Schools! BC* initiative appears to be an effective means to prevent children from developing CVD risk factors early in life.

Figure 5.9 describes the change in aerobic fitness level of the *Action Schools! BC* participants, assessed by their performance in the Leger’s 20m shuttle run. Children in the Liaison and Champion schools showed a significantly greater improvement in aerobic fitness than children in the Usual Practice schools.

**Figure 5.9.** Mean adjusted change (percent) in aerobic performance of the *Action Schools! BC* participants by intervention group over the study period.



### 5.3 Healthy Weight

*One in six boys and one in ten girls in Action Schools! BC schools were overweight or obese at the start of the study.*

*One of five children had greater than 33% body fat. Adults with greater than 33% body fat are 15 times more likely to have an adverse CVD risk factor profile.*

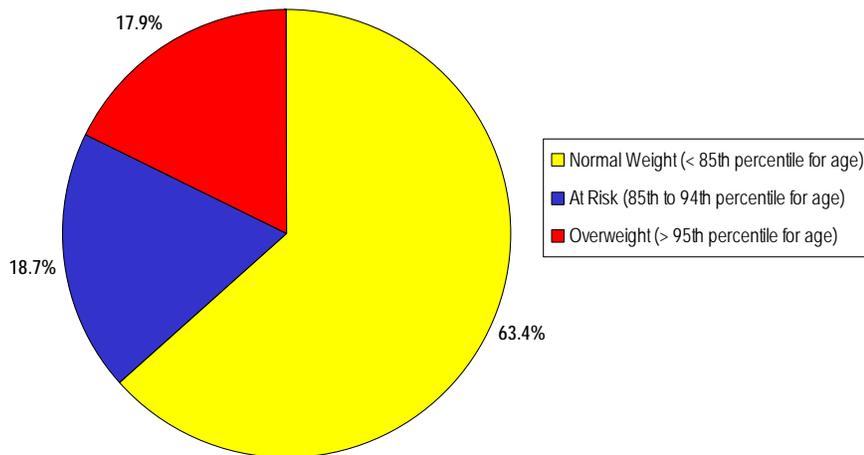
Research Questions:

1. What was the relationship between physical activity and body weight in children overall?
2. Did the increased physical activity delivered by the Action Schools! BC model have a positive effect on body weight in children?

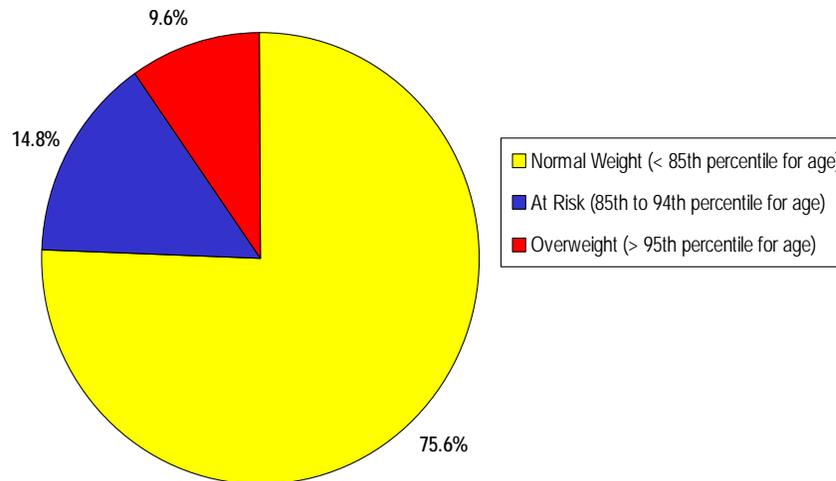
*How many children were identified as At Risk and Overweight at baseline?*

As previously outlined, BMI was calculated and used to classify the percentage of children who were **At Risk** of overweight and **Overweight** based on standards published by the US Centers for Disease Control (USCDC) (Figure 5.10, 5.11). **At Risk** was defined as a BMI greater than or equal to the 85<sup>th</sup> percentile, but less than the 95<sup>th</sup> percentile for age, and **Overweight** as having a BMI greater than or equal to the 95<sup>th</sup> percentile for age.<sup>52</sup>

**Figures 5.10. Prevalence of At Risk and Overweight among Action Schools!  
B.C. boys by Body Mass Index at baseline.**



**Figure 5.11. Prevalence of At Risk and Overweight among *Action Schools! BC* girls by Body Mass Index at baseline.**



At the beginning of the study, a large proportion of children were At Risk (15 to 18 per cent) or Overweight (9 to 18 per cent) (Table 5.4). Twice as many boys as girls were Overweight.

Mean per cent body fat for girls in the At Risk category was 35 per cent (3), on average. Mean per cent body fat for girls in the Overweight category was 39 per cent (3), on average. For boys these values were 31 per cent (4) for At Risk and 37 per cent (4) for Overweight. Percentage body fat greater than 33 per cent is considered a significant risk factor for cardiovascular disease in adults.

***The prevalence of At Risk and Overweight boys in the Usual Practice schools exceeded prevalence in Swedish, American and Australian boys.***

When the proportions of At Risk and Overweight children were combined, the overall prevalence of those children above the 85<sup>th</sup> percentile for BMI (24 per cent for girls and 37 per cent for boys) agrees with previously published incidence rates for children in Canada (26 per cent in girls and 37 per cent in boys).<sup>53</sup> This is higher than the prevalence reported for Australian and for Swedish children, and lower than American children of the same age. The 18 per cent proportion of overweight boys was notably higher than

the 10 per cent reported for Canadian children in the 1996 NLCSY survey<sup>54</sup>. These data typify the increasing level of body fatness in Canadian boys since 1996. A higher prevalence of overweight in boys than girls has previously been reported in a smaller cohort of BC children<sup>55</sup>. Of great concern, the prevalence of At Risk and Overweight for boys in the Usual Practice schools exceeded those of Swedish, American and Australian boys.<sup>56</sup>

**Table 5.4. Proportion of At Risk and Overweight in Action Schools! BC participants by sex and intervention group.**

<b>Intervention Group</b>	<b>Proportion of At Risk Boys</b>	<b>Proportion of Overweight Boys</b>	<b>Proportion of At Risk Girls</b>	<b>Proportion of Overweight Girls</b>
<b>Usual Practice</b>	23 per cent	24 per cent	16 per cent	5 per cent
<b>Liaison</b>	17 per cent	15 per cent	12 per cent	9 per cent
<b>Champion</b>	17 per cent	16 per cent	17 per cent	9 per cent
<b>All Schools</b>	19 per cent	18 per cent	15 per cent	9 per cent

*Was there a relationship between BMI and physical activity score?*

Baseline BMI was highly related to final BMI and BMI percentile (baseline and final), suggesting that these indicators are in agreement and that the rank order of the children remained stable over eighteen months. Physical activity score was not related to BMI or BMI percentile at baseline and physical activity scores tended to be fairly consistent across BMI groups. Physical activity was also unrelated to changes in BMI over the study period.

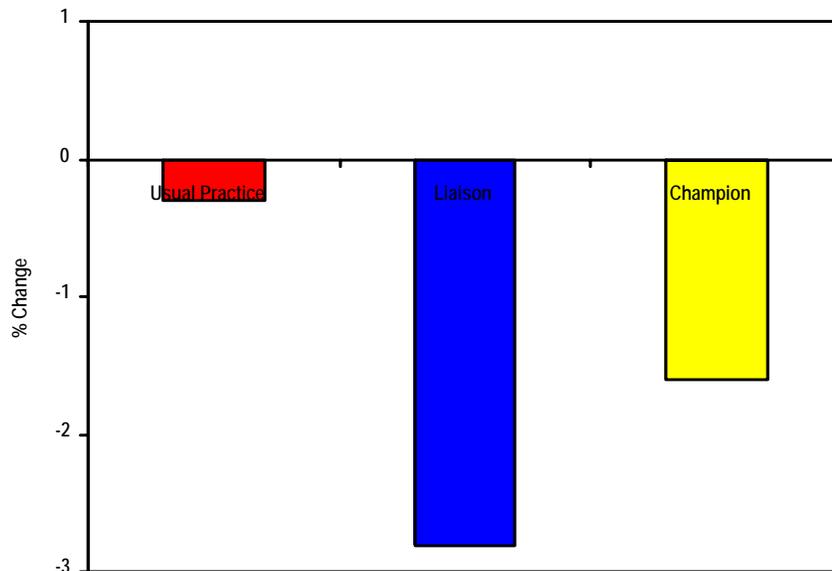
It is unlikely we would observe a relationship between physical activity and BMI given the tremendous variability in the growth of these children. We would be more likely to see an association between physical activity and change in relative body fatness once growth levels off (and thus variability among children decreases) at the end of adolescence (approximately 15 years old for girls and 17 years old for boys). Results may also suggest over-reporting of physical activity amongst the children with high BMI. Over reporting has been noted in previous studies that showed children overestimated physical activity by up to 50 per cent<sup>57</sup> in a subjective questionnaire.

*Did Action Schools! BC affect healthy weight profile?*

The change in BMI between Usual Practice, Liaison or Champion groups was not significant. However, results indicated a decreasing trend (-2.2 per cent) in Overweight boys towards a more healthy per cent body fat in Liaison and Champion groups whereas the Usual Practice group did not show this improvement (Figure 5.12). This result is not surprising as sustained initiatives (4-6 years) that target healthy lifestyle

behaviours in children are required to curtail the escalating prevalence of obesity on children.

**Figure 5.12. Change (per cent) in per cent body fat in Overweight (95<sup>th</sup>+ percentile by Body Mass Index) *Action Schools! BC* boys from baseline to follow-up by intervention group.**



Although past physical activity initiatives have been relatively ineffective in weight reduction school-based programs like *Action Schools! BC* may be effective over time. Larger studies have reported a positive effect for physical activity on BMI. In 11,887 American boys and girls, aged ten to fifteen years old,<sup>58</sup> an increase in physical activity over twelve months was associated with decreasing BMI<sup>59</sup> and an increase in *inactivity* was associated with increasing BMI in girls.<sup>60</sup> The effect of a program such as *Action Schools! BC* on BMI or body fat is difficult to discern over this relatively short timeframe – thus more sustained programs are needed.

#### 5.4 Healthy Bones

*Research Questions:*

1. What was the relationship between physical activity and bone health in children at the start of the study?
2. Did increased physical activity delivered by the *Action Schools! BC* model have a positive effect on the bone health profile in children?

***What was the Action Schools! BC participants' bone mass profile at the beginning of the study?***

At baseline there was no statistically significant differences among the Liaison, Champion and Usual Practice schools for bone or lean mass measures. Boys tended to have a significantly higher total body bone mass, hipbone mass and total body lean mass compared with girls. Girls who participated in organized sport had a higher hipbone mass compared with girls who did not engage in these activities. Girls who participated in more weight bearing physical activities had higher total body bone mass than those who did not. Boys who were more physically active had higher bone and lean mass compared with less active boys. The strongest association was noted for physical activity and hip bone mass. Thus, physical activity was positively associated with bone health. This has been demonstrated consistently in other studies.

***Did Action Schools! BC have a positive effect on children's bone health?***

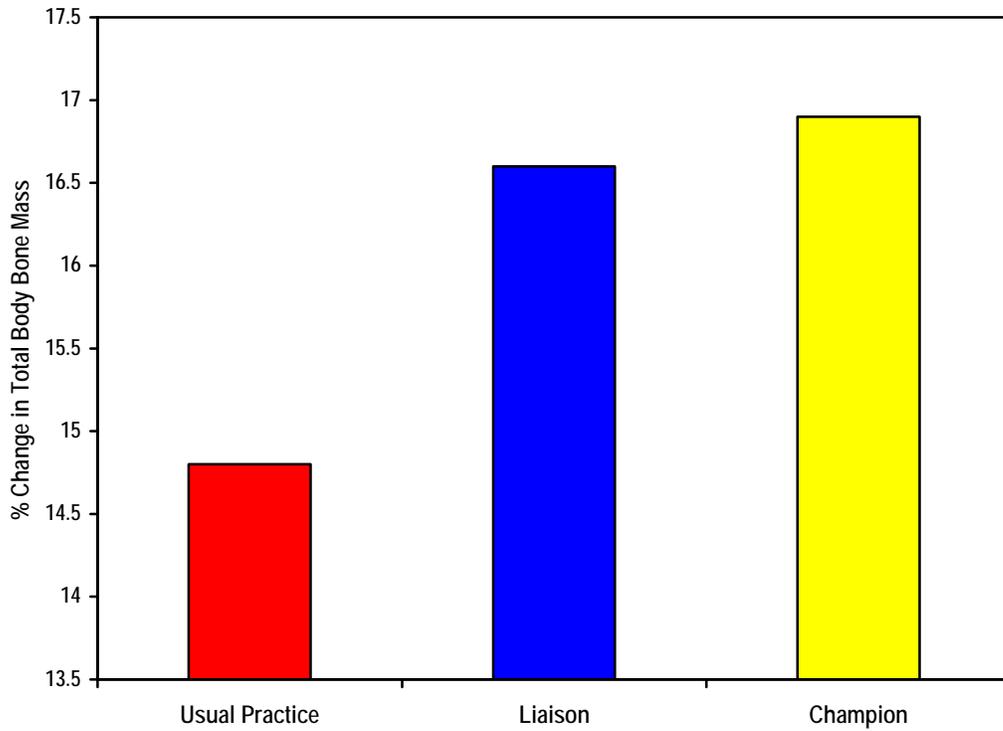
***Action Schools! BC was an effective means to enhance bone health in boys and girls.***

*Action Schools! BC* was an effective means to enhance bone health in children. Children attending *Action Schools! BC* schools gained significantly more bone mass than children attending Usual Practice schools. Boys in *Action Schools! BC* schools gained 2 per cent (approximately 22 grams) more total body bone mass than boys in the Usual Practice schools. Girls in the Liaison and Champion groups gained approximately 2.6 per cent more bone mass at the hip than girls in the Usual Practice group. It is particularly important to build and maintain bone mass in this area because the hip is a common site of clinical fracture in older populations. Entering adulthood with a higher peak bone mass may place individuals at a decreased risk for osteoporosis as bone mass decreases with advancing age in both men and women.

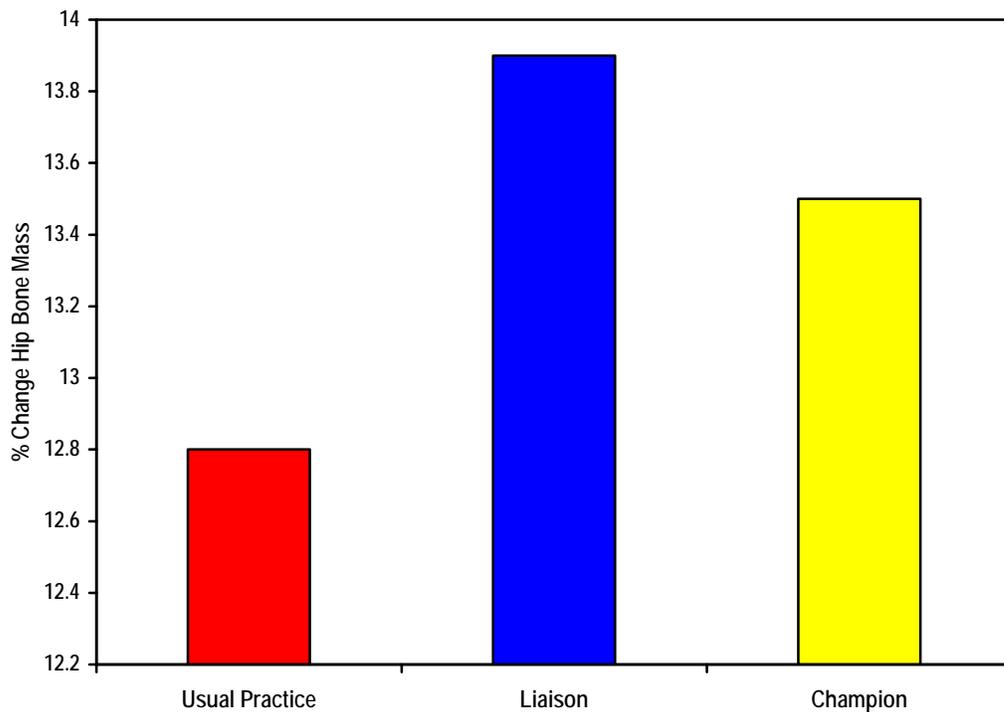
The bone densitometry scans also revealed valuable information about total body lean mass. Physical activity positively effected change in girls' total body lean mass, which is a surrogate for muscle strength. For every one-minute increase in physical activity, girls gained approximately five grams more lean mass. Previous studies have closely linked enhanced muscle mass with increased bone strength. Overall, average physical activity score was a significant predictor of change in hipbone mass and total body lean mass.

Figure 5.13 describes the change in Total Body Bone Mass in *Action Schools! BC* boys. Boys in both the Liaison and Champion groups gained significantly more total body bone mass than boys in the Usual Practice group. Similar results were observed at the hip for girls where girls in the Liaison and Champion groups gained considerably more bone mass at the hip compared with the Usual Practice group (Figure 5.14).

**Figure 5.13.** Change (per cent) in Total Body Bone Mass in *Action Schools! BC* boys by intervention groups across the study time period.



**Figure 5.14.** Change (per cent) in hipbone mass in *Action Schools! BC* girls by intervention group across the study time period.



## 5.5 Healthy Self

*Both boys and girls grew increasingly self-critical as they approached adolescence.*

*Children were more likely to engage in physical activity if their parents encouraged them.*

Perceived competencies decreased across the seventeen-month intervention in all age, gender, race and physical activity groups, with no evidence to suggest these outcomes differed between *Action Schools! BC* Liaison, Champion or Usual Practice schools. Both boys and girls grew increasingly critical of their perceived selves as they approached early adolescence. Future participants would benefit from *Action Schools! BC* resources that directly target self-esteem. It appears that such elements are needed if self-esteem is to be maintained at this age-level and as children mature.

Motivation for leisure-time physical activity is a critical part of actual participation. Research has demonstrated that positive experiences in school contribute to voluntary involvement in physical activity during free time. The *Action Schools! BC* Evaluation Team assessed physical activity motivation with the group during the five evaluation periods using theories of planned behaviour<sup>61</sup> and information from the PAQ-C questionnaire. Again, there was no difference amongst the Liaison, Champion and Usual Practice groups, nor was there a notable difference based on age, gender, race or prior physical activity level. *Action Schools! BC* did not appear to have an effect on leisure-time and physical activity motivation.

Use of the theory of planned behaviour to predict leisure-time behaviour did identify enjoyment level, perception of free time, perception of locations to engage in physical activity, and parental encouragement as key positive factors. This indicates that participation levels could be increased by providing opportunities for children to engage in after-school physical activities and by parents' involvement in promoting physical activity to their children.

It would be important to assess these children after an additional year of intervention, as the study may not have been of sufficient duration to positively affect these Healthy Self behaviours.

## 5.6 Healthy Eating

*Children were not consuming adequate amounts of calcium, fruits and vegetables.*

*Research Question:*

*Can a school-based healthy eating education initiative such as the Action Schools! BC model have a positive effect on children's eating habits?*

*Were the children eating a diet healthy enough for optimal growth?*

Only 21 per cent of boys and 16 per cent of girls were meeting the Dietary Reference Intake for calcium (1300mg/day for children 9-18 years) at baseline. When calcium intake results were averaged over the five measurement periods, 91 per cent of girls and 84 per cent of boys<sup>62</sup> were not meeting the recommended Dietary Reference Intake for calcium.

None of the children met the minimum recommendation of five servings of fruit and vegetables per day in either the September or June measurement periods.

*Did the Action Schools! BC 5-TODAY Model increase fruit and vegetable intake?*

There were no statistically significant differences amongst Liaison, Champion and Usual Practice groups for intake of fruits and vegetables over the 8-month school year. These results are not surprising given the short eight-week duration of the 5-TODAY Model and the relatively short eight-month time frame of the observation.

*Did the 5-TODAY Model increase the awareness of minimum intake amounts?*

*By the end of the study, children in the Action Schools! BC schools were more aware of the minimum recommended intakes of fruits and vegetables than they were at the start of the study.*

As the school year progressed, more students were aware that they should consume between five to ten servings of fruits and vegetables per day. This suggests that children's knowledge about fruits and vegetables increased as a result of the 5-TODAY Model. However, this increased knowledge did not appear to effect children's food choices. Awareness of healthy food choices increased significantly more in the Liaison and Champion schools compared with Usual Practice schools.

## **Integrating Healthy Eating into the Curriculum**

Many teachers appreciated that the 5-TODAY Model was flexible and allowed them to integrate learning about fruits and vegetables into their curriculum. Teachers stated that the lesson plans were clear, well presented and easy to use.

*“It worked really well because that was the material that we used as part of our science unit...we approached it in a very serious scientific manner and [the students] took ownership of their work.” – Teacher participant*

The teachers also reported positive changes in their classroom as a result of the 5-TODAY Model, such as students bringing more fruits and vegetables for snacks.

*“I am noticing kids bringing vegetables and fruits now for snack. When I pack my own lunch, believe it or not, I am looking at fruits and vegetables now.” - Teacher participant*

*“At the PAC meeting some of these parents have kids in these classes and they said that kids are asking at the grocery store for certain fruits.” – Teacher participant*

All teachers agreed that the promotion of good nutrition through increased fruits and vegetables intake was important. Suggestions for improvement to the 5-TODAY Model were to increase its accessibility for the Grade 4 and 5 levels by including more visuals and a vocabulary section. Teachers also suggested that varying the message and teaching the students longer lessons, more often would be helpful. Some teachers also suggested that introducing a Healthy Eating curriculum at a younger grade level would create a good foundation for positive eating habits.

## **5.7 Academic Performance**

***Children in the Action Schools! BC schools significantly improved their academic performance.***

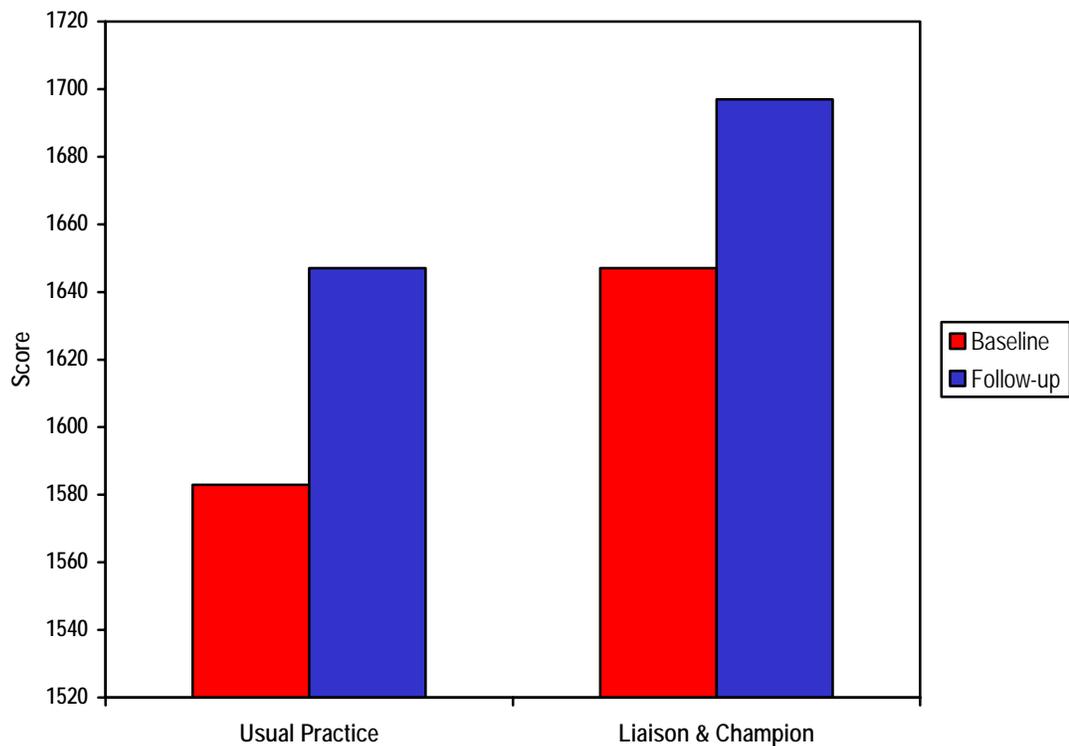
*Research Question:*

*Did Action Schools! BC have a positive effect on academic performance over one year?*

The academic performance assessment provided important insights. Age at baseline was related to reading, math and language scores. Girls out-performed boys in academic achievement and tended to have higher average scores in reading and math. After controlling for baseline total scores, gender was a significant predictor of total final scores with boys scoring 40 points lower, on average, compared with girls. Final score was not significantly associated with being in the Intervention or Usual Practice schools.

A significant change was observed from baseline to final in total score (Figure 5.15) and math score (Table 5.8.1) in both *Action Schools! BC* and Usual Practice schools as measured by standard tests. That is, although *Action Schools! BC* schools spent less time in curricular activities they performed just as well academically as children in Usual Practice schools. This finding is consistent with other studies that demonstrated that when additional time is dedicated to physical activity, students performed as well or even better academically than students not receiving additional physical activity<sup>63</sup>. A study from the California Department of Education (CDE) showed a direct relationship between physical activity and academic performance.

**Figure 5.15. Total average scores in academic performance evaluations at baseline and follow-up for *Action Schools! BC* participants.**



**Table 5.8.1 Baseline (T2) and final (T5) math score results by group.  
Mean (SD)**

	Math (T2)	Math (T5)	p-value
<b>Intervention</b>	511 (62)	538 (68)	<0.01
<b>Control</b>	548.4 (67)	564 (63)	0.008

## 5.8 Process Evaluation

The process evaluation results showed that the *Action Schools! BC* Model provided more opportunities for children to be active during the school day. Teachers were “very to extremely satisfied” with the resources and support they received. Administrators, students and parents were also very satisfied with the intervention.

Key findings from the process evaluation were:

### *Training*

- 1) 97 per cent of teacher participants were very or extremely satisfied with the content and the delivery of the training.
- 2) 69 per cent of the teachers reported that the content of the Action Schools! BC training was new.
- 3) 85 per cent of the teachers rated the training as very to extremely useful.
- 4) 75 per cent of the teachers left the workshop feeling confident to very confident in their ability to go out and use the activities in their class.
- 5) 83 per cent of teachers intended to use the activities they learned in their classroom in the upcoming term.

### *Resources*

- 1) 82 per cent of the teachers rated the written resources as very or extremely useful.
- 2) 100 per cent of the teachers rated the Action Bin as very or extremely useful.
- 3) 100 per cent of the teachers said their administrator was very or extremely supportive.

*Action Schools! BC Facilitator*

- 1) Over 80 per cent thought having a facilitator was very or extremely useful.
- 2) 92 per cent were very or extremely satisfied with the facilitator support.

***What did the Action Plans look like?***

Evaluation of the Action Plans showed that activities were planned in all six Action Zones. Four hundred and fifty-six different activities were planned between September 2003 and June 2004, with the greatest percentage of activities planned in the Scheduled PE and Extra-curricular Action Zones. Non-PE Classroom Action activities represented approximately 20 per cent of the activities planned.

***Were the schools satisfied with the Action Schools! BC teacher training?***

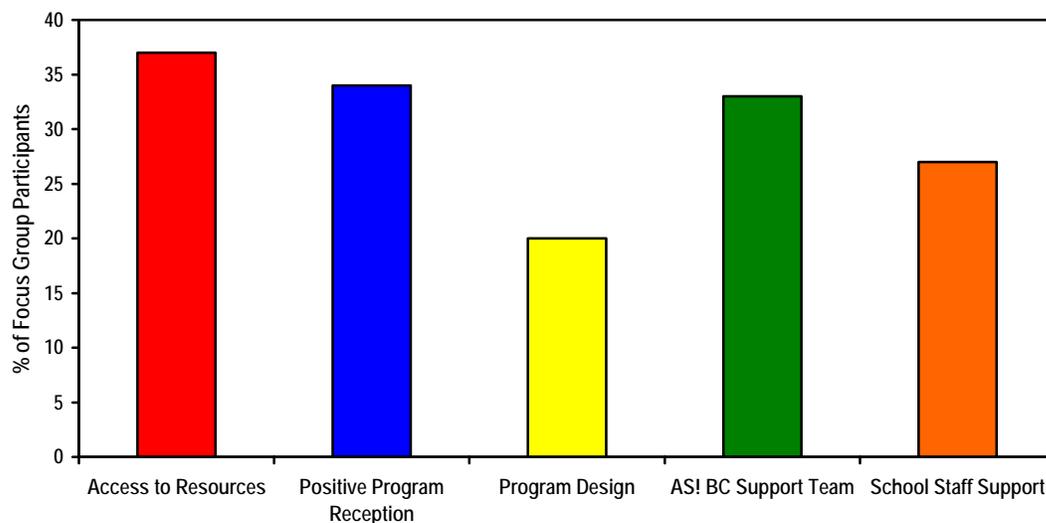
The teacher participant evaluations from seven training workshops provided by the *Action Schools! BC* staff and facilitators between September 2003 and June 2004 indicated high levels of satisfaction with the training. Training by the *Action Schools! BC* Support Team and Master Trainers enhanced teachers' belief in their abilities to implement activities in their classroom and their intention to deliver healthy activities.

***What did the teachers and administrators identify as facilitating factors?***

Teachers who implemented *Action Schools! BC* were highly satisfied with the resources, the support they received from the *Action Schools! BC* Master Trainers, the *Action Schools! BC* Support Team and their school administrator. Teachers and administrators cited access to resources, positive reception of the program, program design, *Action Schools! BC* Support Team and school staff support as key facilitating factors.

Figure 5.16 shows the major facilitating factors described by *Action Schools! BC* administrators and teachers during the focus groups.

**Figure 5.16. Facilitating factors identified by Action Schools! BC administrators and teachers in focus groups conducted during the process evaluation.**



Almost all, (87 per cent) of administrator and 82 per cent of teacher comments were positive. Negative administrator comments generally related to the demands of data collection (recording tracking) and teacher reluctance to commit the time required for the program. Teachers concerns included that some children were not receiving the intervention, the additional curriculum components, scheduling and coordination difficulties and time constraints. On the other hand, teachers reported benefits such as the creation of a new and very positive school culture, children’s enjoyment of the program, access to new activities and resources and recognition for being the part of a greater purpose. Over half (57 per cent) of teachers suggested that his or her reason for becoming involved in the *Action Schools! BC* pilot had changed from being obligated to becoming enthusiastic about Action Schools! BC and motivated by an increased awareness of the importance of physical activity for children’s health and performance.

***What barriers did teachers and administrators come up against during the pilot?***

Teacher constraints such as curriculum demands, difficulty remembering, prep time requirements, report cards, physical barriers, scheduling and coordination difficulties and time constraints were cited as the major barriers to the *Action Schools! BC* model. These represent the business of schools and are likely to be encountered regularly. Teachers, in most cases successfully identified strategies to overcome these obstacles.

***What benefits did the Master Trainers identify?***

The Master Trainers reported witnessing the positive effects of the program as the major benefit of *Action Schools! BC*. Other benefits included the growth of teachers' belief in the program, the trickle-down effect in the larger community and increased enthusiasm expressed by the children.

## 6. Conclusions

Not surprisingly, there was a strong association between physical activity and child health across a range of health outcomes.

The *Action Schools! BC* model was an effective means to improve the health profiles of children in the following areas:

- Physical Activity
- Healthy Hearts (Cardiovascular health)
- Healthy Bones
- Academic Performance

The *Action Schools! BC* model was effectively delivered by the generalist teacher in the classroom, the gymnasium and as a part of extracurricular activities.

It was not possible to discern a benefit of the Action Schools! BC model on healthy weight and it is likely that the relatively short intervention time frame was not sufficient to allow this.

Children became increasingly self-critical as they approached maturity and programs that specifically target emotional and mental health may be an effective means to offset these tendencies in children.

The Healthy Eating component of the Action Schools! BC model should be enhanced and incorporated into the School Plan for a longer duration if dietary habits of children are to be improved.

*Action Schools! BC* was popular with teachers, administrators, parents and students- all of whom described their positive experiences as participants in the *Action Schools! BC* initiative.

## 7. Recommendations

Based on the positive benefits demonstrated in Phase I of *Action Schools! BC*, physical activity and healthy eating school initiatives should be enhanced, supported and sustained.

We recommend the following:

### **Invest in teachers**

Generalist teachers responded very positively to the training and the support they received as a part of *Action Schools! BC*. Thus empowered, teachers were committed and interested participants in creating a healthy school environment and the health of their students.

### **Educate teachers about the academic performance benefits of physical activity.**

Schools that undertook significantly more minutes of physical activity per week performed at least as well academically as schools that did not. Thus a commitment to a healthy school environment also promotes a healthy academic environment.

### **Focus on girls to encourage increased physical activity.**

As in previous studies girls' physical activity levels were significantly lower than boys' in all schools. Novel physical activities that attract and encourage participation by girls should be supported and promoted in schools.

### **Focus on boys to encourage healthy body weight.**

There were three times as many overweight boys as overweight girls at final measurement. The prevalence of overweight boys in the control schools exceeded that of children in the United States. The development and implementation of physical activity and healthy eating initiatives within schools that empower and appeal to boys is required.

### **Focus on low active children.**

Encourage and support the provision of programs within schools that appeal to children, regardless of physical activity level or skill level.

### **Identify and intervene with those children at greatest risk for developing adult chronic disease.**

Fifty-five per cent of children presented with at least one risk factor for cardiovascular disease. Establish a pathway of support for these children, and their parents.

**Promote activities that develop a healthy skeleton.**

An investment of only a few classroom minutes each day in activities such as jumping or skipping enhanced bone health was beneficial. Devise a means to incorporate these activities into the school day on a regular basis.

**Develop programs and activities aimed at improving self-concept in children.**

The evaluation found that children became increasingly self-critical as they approached puberty. Customize and deliver programs or activities to specifically reverse this trend.

**Develop a comprehensive component on healthy eating.**

Healthy eating and physical activity go hand in hand. Design and implement an enhanced component of healthy eating that complements *Action Schools! BC* physical activity choices.

**Monitor the *Action Schools! BC* participants as they continue to grow.**

It is likely that the benefits of *Action Schools! BC* will become more evident over time. Commit to a sustained investment in a healthy school environment so that longer-term health benefits, including curbing overweight and obesity, for children can be examined.

**Evaluate the effectiveness of the model on a population basis.**

It is important to determine if *Action Schools! BC* can be undertaken effectively on a large scale by school districts and schools in diverse geographic settings and with diverse populations (such as First Nations) across British Columbia.

**Expand the model to encompass Grades K-3 and middle school.**

Benefits will continue only if programs are available to students at every grade level. This is especially true in middle school when a decline in physical activity most often occurs.

**Engage government ministries across sectors to support a provincial plan of action to improve the health of BC children.**

The *Action Schools! BC* findings support many of the recommendations outlined in *An Ounce of Prevention – A Public Health Rationale for the School as a Setting for Health Promotion: A Report of the Provincial Health Officer (October 2003)*, specifically:

**Re-commit to support Healthy Schools initiatives.**

Risk factors in children can be reduced through comprehensive preventative education initiatives and interventions like *Action Schools! BC*. These types of healthy schools initiatives focus on the school environment as well as on the

larger community and their role in establishing healthy patterns of behaviour in early childhood education.

**Develop and implement an evidence-based curriculum that runs from school entry to graduation as part of a comprehensive school health promotion process.**

The school health curriculum should be based on best-practice evidence of what works.

- Teachers have reported difficulty in prioritizing health and physical activity into the school day.
- The *Action Schools! BC* findings suggest that time taken from academic curriculum and put into physical activity has a positive impact on academic performance.
- The potential savings in future health care costs indicates that there also may be a strong business case for investing in school health.
- The Physical Education curriculum should be supported at all grade levels with middle and high school initiatives, as benefits will not persist if the programs are withdrawn during the years when drop-out occurs.

Innovative initiatives such as *Action Schools! BC* will make B.C. a world leader in evidence-based programs, practices and policies.

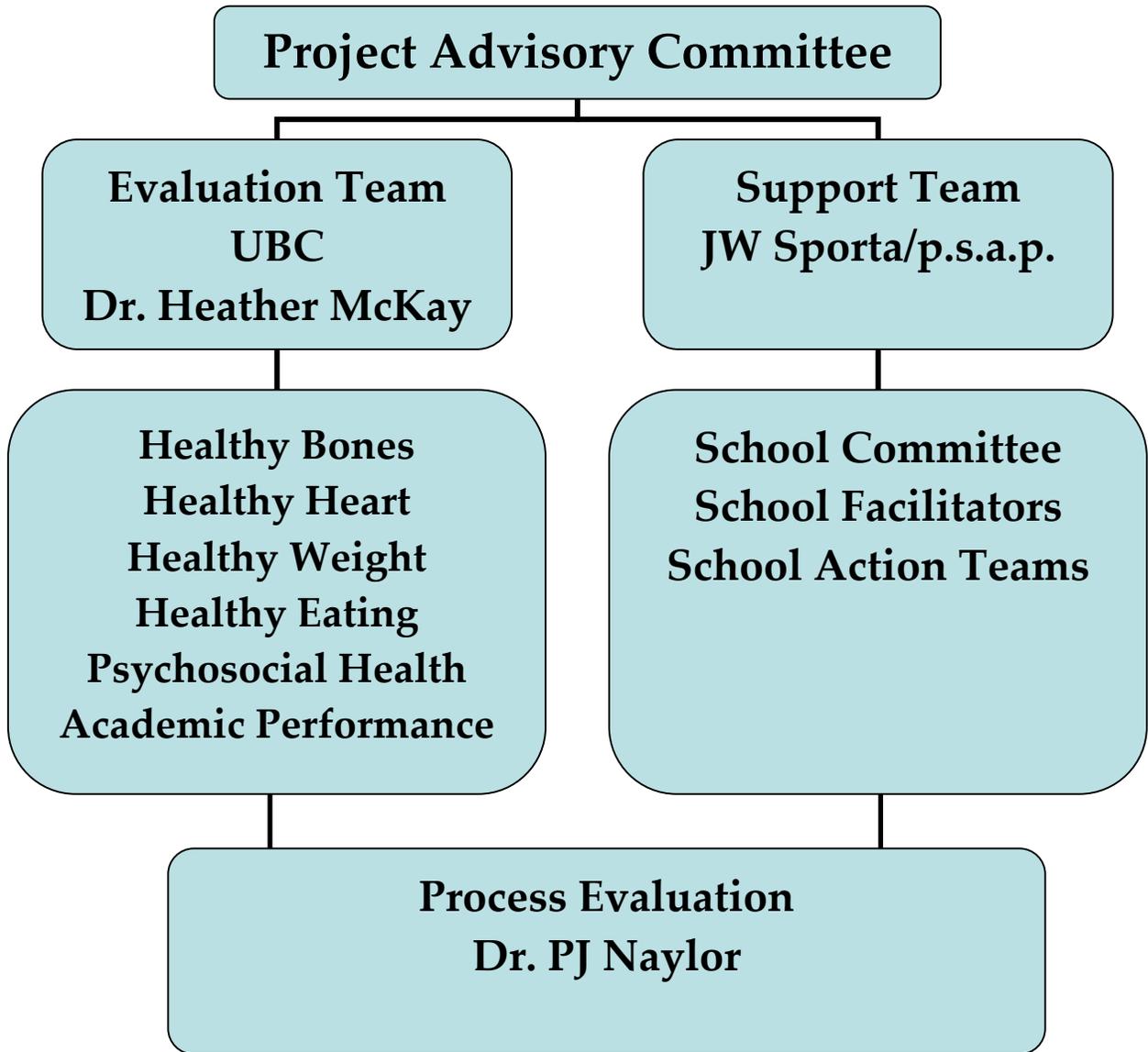
**Develop an infrastructure (staff) at the provincial and regional levels to support implementation of comprehensive school health promotion.**

Enriching the infrastructure of staff skilled in the theory and practice of school health at the provincial and regional levels is important. Teachers need support and access to up-to-date resources in order to implement programs that are based on the most current best-practices information.

**Establish a formal mechanism whereby all related ministries and other stakeholders in child and youth health contribute to comprehensive school health promotion.**

The *Action Schools! BC* model has successfully integrated resources from multiple ministries and initiatives. High-profile projects like the 2010 Olympic and Paralympic Winter Games can be linked with physical activity health for all British Columbians. Continuing communication across the Ministry of Health, the Ministry of Education, the Sport Branch and initiatives like *2010 LegaciesNow* and integrating actions at all government levels will promote active, healthy schools, communities, worksites and British Columbians of all ages.

**Appendix 1: Action Schools! BC – Organization Chart**



**Appendix 2: *Action Schools! BC* Action Plan**



# Action Schools! BC Action Plan

School Year: \_\_\_\_\_

Complete this form to develop your School and/or Classroom Action Plans. Use the Action Schools! BC Planning Guide or contact the Action Schools! BC Support Team for assistance. 604.738.2468 or 1.800.565.7727 or info@actionschoolsbc.ca

Action Schools! BC  
School/SD#: \_\_\_\_\_

Grade/Div: \_\_\_\_\_

Send completed plans to the Action Schools! BC Support Team:

Plan: circle one: School Teacher \_\_\_\_\_

Date: \_\_\_\_\_

fax 604.737.6043 or email info@actionschoolbc.ca

Completed By: \_\_\_\_\_

Goal Statements (see Guide)	Actions (see Guide)	Date(s) or Timing for Action
<b>Action Zone - SCHOOL ENVIRONMENT - policies, professional development, facilities/equipment</b>		
<b>Action Zone - SCHEDULED PHYSICAL EDUCATION - Gr 4-7 (150min/wk) - Active Living, Movement, Personal and Social Responsibility, Cultural</b>		PE schedule (e.g. 2x40min/wk):
Achieve curriculum outcomes		
<b>Action Zone - CLASSROOM ACTION - 15 x 5, health, nutrition</b>		
Provide ____ min/day of physical activity (outside of scheduled PE)	Action Schools! BC Action 15 X 5	All year, September - June
<b>Action Zone - FAMILY &amp; COMMUNITY - active field trips, guest demonstrations, family nights</b>		
<b>Action Zone - EXTRA-CURRICULAR - clubs, intramurals, team sports</b>		
<b>Action Zone - SCHOOL SPIRIT - school wide events</b>		

**Appendix 3**      *Action Schools! BC – Weekly Activity Log*



Action Schools! BC

# Action Schools! BC Weekly Activity Log

School / District #:	
Teacher:	
Grade:	
Division:	
Week of:	

MONDAY			TUESDAY			WEDNESDAY			THURSDAY			FRIDAY		
FREQ	DUR													
Scheduled PE:			Scheduled PE:			Scheduled PE:			Scheduled PE:			Scheduled PE:		
Classroom Action:			Classroom Action:			Classroom Action:			Classroom Action:			Classroom Action:		
Bounce at the Bell			Bounce at the Bell			Bounce at the Bell			Bounce at the Bell			Bounce at the Bell		
Classroom Workout			Classroom Workout			Classroom Workout			Classroom Workout			Classroom Workout		
Energy Blasts			Energy Blasts			Energy Blasts			Energy Blasts			Energy Blasts		
Grippers			Grippers			Grippers			Grippers			Grippers		
Exercise Bands			Exercise Bands			Exercise Bands			Exercise Bands			Exercise Bands		
Chair Aerobics			Chair Aerobics			Chair Aerobics			Chair Aerobics			Chair Aerobics		
Head-Toe Warm-up			Head-Toe Warm-up			Head-Toe Warm-up			Head-Toe Warm-up			Head-Toe Warm-up		
Skipping			Skipping			Skipping			Skipping			Skipping		
Playground Circuit			Playground Circuit			Playground Circuit			Playground Circuit			Playground Circuit		
Timed Running			Timed Running			Timed Running			Timed Running			Timed Running		
Tag			Tag			Tag			Tag			Tag		
Playground Games			Playground Games			Playground Games			Playground Games			Playground Games		
5-TODAY nutrition			5-TODAY nutrition			5-TODAY nutrition			5-TODAY nutrition			5-TODAY nutrition		
Other Zones:			Other Zones:			Other Zones:			Other Zones:			Other Zones:		

**Comments:**

## Endnotes

- 
- <sup>1</sup> [http://www.who.int/health\\_topics/chronic\\_disease/en/](http://www.who.int/health_topics/chronic_disease/en/)
- <sup>2</sup> British Columbia Nutrition Survey – Report on Physical Activity and Body Weight, Ministry of Health Services, March 2004.
- <sup>3</sup> Canadian Community Health Survey, Statistics Canada 2000/01.
- <sup>4</sup> World Health Organization. Fact Sheet No 173, March 2003.
- <sup>5</sup> AS! BC over five measurement periods February 2003 to June 2004.
- <sup>6</sup> Population Health Surveillance and Epidemiology, 2002.
- <sup>7</sup> Data source: Statistics Canada, Canadian Community Health Survey 2003.
- <sup>8</sup> BC Ministry of Health Services, Strategic Policy & Research Branch, January 2001.
- <sup>9</sup> BC Nutrition Survey – Report on Physical Activity and Body Weight, Ministry of Health Services, March 2004
- <sup>10</sup> The Canadian comparative data for body weight/mass (BMI) reported to the OECD uses the CCSH data.
- <sup>11</sup> An Ounce of Prevention - A Public Health Rationale for School as a Setting for Health Promotion, BC Ministry of Health Planning, October 2003.
- <sup>12</sup> Statistics Canada. *The Daily*, December 2, 2002.
- <sup>13</sup> World Health Organization. (1997). Obesity: Preventing and managing the global epidemic – report of a WHO consultation on Obesity. Geneva: World Health Organization. Retrieved on July 15, 2003 from [http://www.who.int/nut/documents/obesity\\_executive\\_summary.pdf](http://www.who.int/nut/documents/obesity_executive_summary.pdf)
- <sup>14</sup> Tremblay, M.S. & Willms, J.D. (2000, November). Secular Trends in the body mass index of Canadian children. *Canadian Medical Association Journal*, 167(8), 848-849.
- <sup>15</sup> Statistics Canada, *The Daily*, October 18, 2002.
- <sup>16</sup> World Health Organization. (1997). Obesity: Preventing and managing the global epidemic – report of a WHO consultation on Obesity. Geneva: World Health Organization. Retrieved on July 15, 2003 from [http://www.who.int/nut/documents/obesity\\_executive\\_summary.pdf](http://www.who.int/nut/documents/obesity_executive_summary.pdf)
- <sup>17</sup> A Report on the Health of British Columbians, Provincial Health Officer's Annual Report 2002. BC Ministry of Health Planning, November 2003.
- <sup>18</sup> BC Ministry of Health Services – Population Health and Wellness.
- <sup>19</sup> Obesity cost estimated using economic costs from 1993 adjusted to 1997 costs, as per the report on the Economic Burden of Illness in Canada (Health Canada, 2002).
- <sup>20</sup> Costs include \$217.3 million (2.6% of the province's \$8.5 billion health budget (1999-2000) direct costs, \$58.7 million based on an estimate that the obesity-related population attributable fraction (PAF) for osteoarthritis and musculo-skeletal disorders is 15%), and other adjustments (for BMI between 25 and 27 – this study used 27 as the cut-off for under-reporting of self reported weight – estimated to be at least 10%, for capital and other costs not included in the estimates – about an additional 20%, etc).
- <sup>21</sup> Katzmarzyk, P.T., Gledhill, N. and Shephard, R.J. The Economic Burden of Physical Inactivity in Canada. *CMAJ* 2000. November 28; 163(11): 1435-1440.
- <sup>22</sup> An Ounce of Prevention – A Public Health Rationale for School as a Setting for Health Promotion: A Report of the Provincial Health Officer, BC Ministry of Health Planning, October, 2003
- <sup>23</sup> Deacon, Bruce W. Ministry of Education, Curriculum Branch, Physical Education Curriculum Review Report, November 2001.
- <sup>24</sup> Shepard RJ, LaVallee H, Voile M, La Barre R, Bewaucage C 1994 Academic skills and required physical education: The Trois Rivières Experience CAPHER Research Supplement 1(1): 1-12.
- <sup>25</sup> WHO Euro, 1993.
- <sup>26</sup> Allensworth and Kolby, 1987.
- <sup>27</sup> Canadian Community Health Survey, (Cycle 1.1 2000/01).
- <sup>28</sup> Available at: <http://www.statscan.ca>
- <sup>29</sup> BC Ministry of Education District reports 2002/2003.
- <sup>30</sup> Available at: <http://www.statscan.ca>
- <sup>31</sup> These numbers represent the entire municipality and are not consistent across schools.
- <sup>32</sup> Statistics Canada. (2003.) <http://www.statscan.com>. Canada's ethnocultural portrait: The changing mosaic.

- 
- <sup>33</sup> Statistics Canada. (2001.) <http://www.statscan.com>. 2001 Census Data.
- <sup>34</sup> Janz, K.F., J.D. Dawson, and L.T. Mahoney, Tracking physical fitness and physical activity from childhood to adolescence: the muscatine study. *Med Sci Sports Exerc*, 2000. **32**(7): p. 1250-7.
- <sup>35</sup> Bao, W., et al., Essential hypertension predicted by tracking of elevated blood pressure from childhood to adulthood: the Bogalusa Heart Study. *Am J Hypertens*, 1995. **8**(7): p. 657-65.
- <sup>36</sup> Janz, K.F., J.D. Dawson, and L.T. Mahoney, Tracking physical fitness and physical activity from childhood to adolescence: the muscatine study. *Med Sci Sports Exerc*, 2000. **32**(7): p. 1250-7.
- <sup>37</sup> Bao, W., et al., Essential hypertension predicted by tracking of elevated blood pressure from childhood to adulthood: the Bogalusa Heart Study. *Am J Hypertens*, 1995. **8**(7): p. 657-65.
- <sup>38</sup> Beltran, A., et al, Arterial compliance abnormalities in isolated systolic hypertension. *Am J Hypertens*, 2001. **14**(10 1007-11).
- <sup>39</sup> McVeigh, G., et al., Vascular abnormalities in non-insulin-dependent diabetes mellitus identified by arterial waveform analysis. *Am J Med*, 1993. **95**(4): p. 424-30.
- <sup>40</sup> Leger, L.A.M., D.Gadoury, C.Lambert, J., The multistage 20 metre shuttle run test for aerobic fitness. *J Sports Sci*, 1988. **6**(2): p. 93-101.
- <sup>41</sup> Higgins PB, Gower BA, Hunter GR, Goran MI. Defining health-related obesity in prepubertal children. *Obes Res* 2001; 9(4):233-40.
- <sup>42</sup> Bailey D.A., Faulkner R.A., McKay H.A., (1996.) Growth, physical activity, and bone mineral acquisition. *Exerc Sport Sci Rev* 24:233-266.
- <sup>43</sup> MacKelvie K., McKay H., Petit M., Moran O., Khan K. (2002.) Bone Mineral Response to a 7-Month Randomized Controlled, School-Based Jumping Intervention in 121 Prepubertal Boys: Associations With Ethnicity and Body Mass Index. *J Bone Miner Res* 17:834-844.
- <sup>44</sup> Fox, K.R. (Ed.). (1997). *The physical self: From motivation to well-being*. Champaign, IL: Human Kinetics.
- <sup>45</sup> Fox, K.R. (2000). Self-esteem, self-perceptions and exercise. *International Journal of Sport Psychology*, 31, 228-240.
- <sup>46</sup> O'Dea, J.A. (2001). Self-concept, weight issues, and body image in children and adolescents. *Advances in Psychology Research*, 6, 157-191.
- <sup>47</sup> Harter, S. (1982). The perceived competence scale for children. *Child Development*, 53(1), 87-97.
- <sup>48</sup> Ajzen I. (1991). The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes*, 50, 179-211.
- <sup>49</sup> Shephard R.J. (1997.) Curricular physical activity and academic performance. *Pediatric Exercise Science*. 9:113-125.
- <sup>50</sup> Mitchell, D.L. The relationship between rhythmic competency and academic performance in first grade children. May, 1994. Doctoral Dissertation. Orlando, FL: University of Central Florida Department of Exceptional and Physical Education.
- <sup>51</sup> Freedman, D.S., et al., The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa Heart Study. *Pediatrics*, 1999. **103**(6 Pt 1): p. 1175-82.
- <sup>52</sup> <http://www.cdc.gov/nccdphp/dnpa/bmi/bmi-for-age.htm>
- <sup>53</sup> The Willms et al (2003) study's category of "overweight" would include both those designated as AROW and OW and the 9% designated as "obese" would be included in the OW category in the AS! BC study.
- <sup>54</sup> Willms JD, Tremblay MS, Katzmarzyk PT. Geographic and demographic variation in the prevalence of overweight Canadian children. *Obes Res* 2003;11(5):668-73.
- <sup>55</sup> MacKelvie K., (2002.) UBC Doctoral Thesis: Bone Mass in Children: Effects of Exercise, Maturity and Ethnicity.
- <sup>56</sup> Vincent SD, Pangrazi RP, Raustorp A, Tomson LM, Cuddihy TF. Activity levels and body mass index of children in the United States, Sweden, and Australia. *Med Sci Sports Exerc* 2003;35(8):1367-73.
- <sup>57</sup> Epstein LH, Paluch RA, Coleman KJ, Vito D, Anderson K. Determinants of physical activity in obese children assessed by accelerometer and self-report. *Med Sci Sports Exerc* 1996;28(9):1157-64.
- <sup>58</sup> Berkey CS, Rockett HR, Gillman MW, Colditz GA. One-year changes in activity and in inactivity among 10- to 15-year-old boys and girls: relationship to change in body mass index. *Pediatrics* 2003;111(4 Pt 1):836-43.
- <sup>59</sup> -0.06 kg/m in girls per hour increase in daily activity and -0.22 kg/m<sup>2</sup> in overweight boys.

---

<sup>60</sup> +0.05 kg/m<sup>2</sup> per hour increase in daily TV/video games.

<sup>61</sup> Ajzen I. (1991). The theory of planned behaviour. *Organizational and Human Decision Processes*. 50, 179-211.

<sup>62</sup> AS/ BC over five measurement periods February 2003 to June 2004.

<sup>63</sup> Shephard, R.J. (1997.) Curricular physical activity and academic performance. *Pediatric Exercise Science*. 9:113-125.