AN ECONOMIC EVALUATION OF A TWELVE WEEK WORKPLACE PRIMARY PREVENTION PROGRAM

by

Holly Wollmann

B.HKIN; UBC-Okanagan, 2013

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE

in

The Faculty of Graduate and Postdoctoral Studies
(KINESIOLOGY)

THE UNIVERSITY OF BRITISH COLUMBIA
(Vancouver)

October 2015

© Holly Wollmann, 2015
Abstract

With the majority of adult waking hours spent at the workplace, the financial effects of absenteeism and presenteeism due to chronic disease is increasing. Healthy lifestyle behaviours (such as physical activity, proper nutrition, smoking and alcohol reduction, and mental health management) play a critical role in reducing absenteeism and presenteeism rates. A comprehensive multi-faceted 12 week wellness program (i.e., ACCELERATION) was implemented within a workplace setting to determine its effects on absenteeism and presenteeism. One hour education sessions covered a range of topics from physical activity, proper nutrition, smoking and alcohol cessation to mental health management, and stress coping. Weekly one hour exercise sessions were conducted and exercise logs were also completed at home to monitor activity/exercise levels. The specialized workplace wellness program was designed to examine changes in healthy lifestyle behaviours in relation to employee health status, as well as absenteeism and presenteeism costs. An economic evaluation of the ACCELERATION program was conducted via the distribution of online questionnaires at both baseline and at a 3 month follow up. A total of 50 participants, 35 Females (43.4 ± 11.5 yr) and 15 males (44.9 ± 10.5 yr), completed the 12 week program. The monetary results from the evaluation reported a reduction in absence days by 54.0% from 1.40 to 0.64 per employee and a cost savings average of $155.79 per employee. Presenteeism was reduced by 17.0% from 29.0% to 12.0% equating to an average cost savings of $420.12 per employee. These results indicate that the ACCELERATION program had a positive effect on employee health costs and is a beneficial health program for the workplace.
Preface

This dissertation is an original intellectual product of the primary author (Holly Wollmann) and her supervisory committee (Dr. Darren Warburton, Dr. Shannon Bredin, and Dr. Paul Oh). This work is an extension of the national collaboration entitled ACCELERATION with funding support from the Coalitions Linking Action and Science for Prevention (CLASP). The ACCELERATION program outlined in Chapter 5 was headed by the ACCELERATION collaboration including: Dr. Paul Oh (UHN Toronto Rehabilitation), Dr. Darren E.R Warburton and Dr. Shannon Bredin (Physical Activity Promotion and Chronic Disease Prevention Unit, UBC), Dr. Nicholas Giacomantonio (Dalhousie University), and Dr. Simon Bacon (Jean-Jacques-Gauthier Cardiorespiratory Centre, Concordia University).

All UBC related thesis work was conducted under the guidance of Dr. Darren Warburton and Dr. Shannon Bredin, with assistance from Mr. Bradley Hansen and graduate trainees from the Physical Activity Promotion and Chronic Disease Prevention Unit (UBC).

The data analysis presented in Chapter 5 and subsequent discussion in Chapters 6 and 7 are the original work of Holly Wollmann, as well as the literature review in Chapters 2 through 4. The literature review was conducted under the guidance of Dr. Darren Warburton and Dr. Shannon Bredin. The research reported in Chapter 5 was covered by UBC Ethics Certificate number -03178.
Table of Contents
Abstract ......................................................................................................................... ii
Preface ....................................................................................................................... iii
Table of Contents ......................................................................................................... iv
List of Tables ............................................................................................................... vi
List of Figures ............................................................................................................. vii
List of Abbreviations ................................................................................................. viii
Acknowledgements ................................................................................................... ix

Chapter 1: Introduction .............................................................................................. 1
1.1 Background and Rationale ..................................................................................... 1
1.2 Summary of Objectives ......................................................................................... 4
1.3 Hypotheses ............................................................................................................ 5
1.4 Overview of Document ......................................................................................... 5

Chapter 2: Absenteeism and Presenteeism in the Workplace ...................................... 7
2.1 Absenteeism ......................................................................................................... 7
2.2 Presenteeism ......................................................................................................... 10
2.3 Summary ............................................................................................................... 12

Chapter 3: Chronic Disease in the Workplace ............................................................. 13
3.1 Obesity ................................................................................................................. 13
3.2 Cardiovascular Disease ......................................................................................... 15
3.3 Cancer .................................................................................................................. 19
3.4 Alcohol ................................................................................................................ 22
3.5 Smoking ............................................................................................................... 24

Chapter 4: Physical Activity and Nutrition in the Current Workplace ......................... 26
4.1 The Role of Physical Activity ............................................................................... 26
4.2 The Role of Nutrition ........................................................................................... 28
4.3 Previous Workplace Health Programs ................................................................... 30
4.4 Summary ............................................................................................................... 34

Chapter 5: ACCELERATION and the City of Richmond ........................................... 36
5.1 ACCELERATION Background ............................................................................. 36
5.2 Purpose ............................................................................................................... 36
5.3 Methods .............................................................................................................. 37
5.4 Results ............................................................................................................... 44

Chapter 6: Discussion of the Economic Evaluation .................................................... 52
6.1 Absenteeism Evaluation ....................................................................................... 52
6.2 Presenteeism Evaluation ..................................................................................... 54
6.3 Attendance vs. Cost ............................................................................................. 56
6.4 Employee Health Results ................................................................................... 58
6.5 Conclusion .......................................................................................................... 59
Chapter 7: Future Directions and the Limitations of Workplace Wellness

Health Programs .............................................................................................................................................60
  7.1 Future Directions and Limitations .................................................................................................60
  7.2 Conclusion .......................................................................................................................................61

References .........................................................................................................................................................63

Appendix ........................................................................................................................................................71
List of Tables:

Table 1: Job Positions of Employees participating in ACCELERATION ..................... 39

Table 2: Barriers for Participation in the ACCELERATION Program ....................... 57
List of Figures

Figure 1: Proportional Mortality Rates of Non Communicable Diseases in Canada........2

Figure 2: Proportional Mortality Rates in British Columbia due to Non Communicable Disease’s .........................................................................................................................................................................................2

Figure 3: Participant Adherence Flow Chart ..........................................................................................................................38

Figure 4: Average Cost Savings per Employee based on Individual Reduced Absenteeism........................................................................................................................................................................................................................................45

Figure 5: Average Increased Cost per Employee based on Individual Increases in Absenteeism Rates ........................................................................................................................................................................................................................................45

Figure 6: Average three Month Presenteeism Costs Per Employee at Baseline and 3 Month Post Program Follow Up ........................................................................................................................................................................................................................................47

Figure 7: Employee Changes in Blood Pressure Pre and Post Program .................49

Figure 8: Changes in Employee Body Fat Percentage based on Categories.............49

Figure 9: Employee Predicted Maximal Aerobic Scores at Baseline and Post Program..50

Figure 10: Average Handgrip Scores per Employee and Baseline and Post Program......50

Figure 11: Average Sit and Reach Scores per Employee at Baseline and Post Program...51
List of Abbreviations

Blood Pressure (BP)
Body Mass Index (BMI)
British Columbia (BC)
Canadian Partnership Against Cancer (CPAC)
Cardiovascular disease (CVD)
Chronic Obstructive Pulmonary Disease (COPD)
Coronary heart disease (CHD)
Health and Work Performance Questionnaire (HPQ)
Labor Force Survey (LFS)
Non Communicable diseases (NCDs)
Physical Activity Readiness Questionnaire for Everyone (PAR-Q+)
Potential Years of Life Lost (PYLL)
Rate of Perceived Exertion (RPE)
Return on Investment (ROI)
Return to Work (RTW)
Resting Heart Rate (RHR)
Six Minute Walk Test (6MWT)
Stanford Presenteeism Scale (SPS)
Waist circumference (WC)
World Health Organization (WHO)
Work Limitations Questionnaire (WLQ)
Acknowledgements

First and foremost I would like to thank my supervisor, Dr. Darren Warburton for his guidance and support throughout my Master’s program. Without his guidance, none of this would have been possible. It was an honour to have studied in his laboratory. I would also like to thank my committee members, Dr. Shannon Bredin and Dr. Paul Oh for their advice and assistance throughout my thesis project.

I would like to express my gratitude to Brad Hansen, the CPR Labs research coordinator for all his efforts and help with the ACCELERATION program and lastly to my all lab mates and volunteers who helped make this project a success. Thank You to Alison Dennis, whose cooperation was invaluable to the ACCELERATION program.

Finally, I would like to thank all the participants of this thesis investigation. Without their time and patience, this research project would not have been possible.
Chapter 1: Background Rationale, Thesis Objectives, and Document Overview

This Chapter provides the background rationale of the project, the thesis objectives and hypotheses, as well as an overview of the document.

1. Background and Rationale
1.1.1 Health in Canada and British Columbia

The World Health Organization (WHO) defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (1). Lifestyle choices are vital in determining the degree to which a population may suffer from chronic disease. Non-communicable diseases (NCDs) cause 88% of deaths in Canada (2) and are the major source of health-care costs and lost productivity (2). Cancers, cardiovascular disease (CVD), and smoking related diseases make up nearly 77% of the NCD death statistics, as seen in Figure 1. The Public Health Agency of Canada (2011) notes that the four main diseases: cancer, diabetes, CVD, and chronic respiratory disease all share the same four major risk factors of unhealthy eating, physical inactivity, smoking, and excessive alcohol consumption. These risk factors are modifiable and can assist in the prevention of respective associated diseases with healthy lifestyle choices. As reported by Health Canada (2009), nearly 42% of all Canadians self-reported living with at least one chronic disease (3). Additionally, one in three Canadians between 50-79 yr reported living with three or more chronic diseases (3).

The financial impact of chronic disease on the Canadian economy is enormous. The prevalence of chronic disease and NCD result in significant productivity losses, including but not limited to: premature death, disability, absenteeism, presenteeism, and reduced work quality (2). The Public Health Agency of Canada suggests that chronic disease costs the Canadian economy at least $190 billion annually (2). Healthy lifestyle choices including regular exercise, healthy diet, cessation of smoking, and a reduction in alcohol consumption can mitigate the risks of developing chronic disease.

Within Canada, British Columbia (BC) is ranked as the healthiest province with the lowest reported prevalence of chronic disease (3). Even within BC, chronic disease is the largest cause of death and disability with 62% of deaths associated with cancers, cardiovascular diseases, and cerebrovascular diseases (Figure 2). The total BC health care costs associated with these three
major diseases is estimated to be around $2.8 billion CAD (3). Moreover, one in three British Columbians self-report to be living with one or more diagnosed chronic disease, and nearly 2% of the BC population is living with four to six chronic conditions (3).

**Figure 1: Proportional Mortality Rates of NCD in Canada (2)**

![Proportional Mortality in Canada](image)

**Proportional Mortality in Canada (Percent of total deaths)**

- Smoking Related Disease: 20%
- Respiratory Disease: 7%
- Cancers: 30%
- Diabetes: 3%
- Injuy: 6%
- Other: 7%
- Cardiovascular Disease: 27%

**Figure 2: Proportional Mortality Rates of NCD in BC (3)**

![Proportional Mortality in BC](image)

**Proportional Mortality in BC (Percent of Total Deaths)**

- Cancers: 30%
- Respiratory Disease: 14%
- Diabetes: 3%
- Injuy: 6%
- Other: 15%
- Cardiovascular Disease: 23%
- Cerebrovascular Disease: 9%
Health care focus in Canada is being shifted from the tertiary treatment of chronic disease to primary prevention. Achieving the goal of improved health and wellness will involve major collaborations between the health care system, the public, population health promotion, public health services, and clinical prevention and support systems.

The Workplace has a high prevalence rate of chronic disease. Annually companies are losing money on employees who are involved in absenteeism and or presenteeism related to chronic disease. Absenteeism, defined as the habitual, unscheduled absence from work, has a large financial and productivity impact on the Canadian economy. In contrast, presenteeism is defined as the act of being in the workplace when injured and/or ill, thus reducing productivity. Absenteeism and presenteeism rates are modifiable and can be reduced through physical activity, proper nutrition, and improvement in overall employee health and safety.

The financial costs of absenteeism and presenteeism are divided into direct and indirect costs. Direct costs constitute the benefits and paid income to absent employees including: vacation, holiday, sick, and disability pay. Indirect costs are considered to have the larger financial and productivity impact, and are composed of three main categories of decreased productivity, unexpected employer costs, and administration costs.

The Conference Board of Canada in 2012 reported that workplace absenteeism rates had a direct cost to the Canadian economy of an estimated 2% of gross annual payroll or a total of $16.6 billion (4). This figure did not include associated indirect costs. In 2011, approximately 8% of employed Canadians were involved in an unscheduled absence, equating to 9.3 days of full time work (4).

Presenteeism costs are substantially higher than that of absenteeism at $15-25 billion annually. Canada Life Group Insurance (2013) surveyed 150,000 employees in various work environments and found that 93% of staff self-reported coming into work when ill or injured at some point within a given work year (5). Of this 93%, 87% reported that the illness or injury impaired their working capacity and productivity during the working day (5). Other assessments of presenteeism have revealed that at least 7% of workers were present at work despite health problems on any given day (6).

Nearly half of all absenteeism and presenteeism is related to physical health factors that impair an employee’s ability to perform work related tasks. Major diseases that are associated with absenteeism and presenteeism include: obesity, cardiovascular disease, diabetes, cancer,
smoking, and excessive alcohol consumption. All of these diseases are modifiable with proper nutrition, smoking cessation, and routine physical activity (5). By reducing and preventing the prevalence of these diseases, the rates of absenteeism and presenteeism have been shown to also decline, thus reducing the overall economic impact and potentially saving the Canadian economy billions of dollars each year on health care and disability claims.

Since 60% of the Canadian populations’ waking hours are spent on the job, the workplace is thought to be a prime location to intervene for population health (5). Using the workplace, health initiatives are able to gain access to large groups of people, target sectors and areas that are not normally intervened with, and involve employee’s family and friends in the health program to further extend the initiatives reach.

The Coalitions Linking Action and Science for Prevention or CLASP program is a group of health initiatives that are being implemented across Canada in several specific locations and settings. These programs are aimed at addressing issues such as obesity, cancer and chronic disease screening, tobacco and alcohol cessation, diet and nutrition education, and the unique health needs of the First Nations communities. The ACCELERATION program formed by CLASP and it’s partnerships with the University Health Network, Canadian Partnership Against Cancer (CPAC), Hearts in Motion, Jean-Jaques Gautheir Cardiovascular Centre, and Toronto’s Cardiovascular Rehabilitation Centre, is being implemented Canada wide, targeting 3000 participants over a three year period. It is a multi-faceted structural behavioural risk intervention for specific communities and settings across the country. ACCELERATION aims to: first, deliver an on site prevention program to at risk populations for cancer and chronic disease; and second, to recruit family and friends of people who have suffered an acute event associated with chronic disease and cancer for a similar prevention program. Risk factors that will be focused on are for both interventions are: diet, physical activity, and smoking and alcohol consumption.

1.2 Summary of Objectives

The purpose of this project was to determine whether a 12 week workplace primary prevention program had an impact on employee health status, as well as a reduction in the costs of absenteeism and presenteeism. The objectives of the project were to:

1) Implement the ACCELERATION 12 week program into a city workforce.
2) Examine the influence of the program on absenteeism and presenteeism rates at the start and at a three month post-intervention followup.

3) Create an economic evaluation of the program, to use as a resource for future programs being implemented for companies to get a high return on investment.

1.3 Hypotheses

We hypothesized:

1) Worker absenteeism rates in a three month post intervention analysis would be reduced by 25.0-30.0%, lowering the current prevalence of 54.4% to 40.8-38.1% and cutting the current average of 1.4 days to 1.05-0.98 days. This would reduce the current 3 month average cost from $272.78 per employee to $190.95 - $204.59, creating a total savings of $68.19 – $81.83 per employee.

2) Worker presenteeism costs in a three month post intervention analysis would be reduced by 25.0-30.0%, creating a financial savings from the current average monthly cost of $3890.95 per employee, to a range of $2723.70 - $2918.22, a total savings of $972.73 - $1167.28 per employee.

1.4 Document Overview

This document is divided into eight sections. Chapter 2 provides an introduction on absenteeism and presenteeism prevalence in the workplace and discussed financial impact annually on the Canadian economy and the different ways of measurement. Chapter 3 provides an overview on the influence of chronic disease. Specifically, obesity, cardiovascular disease, and cancer are focused on as they demonstrate the highest mortality and morbidity rates. Additionally, the literature on smoking and alcohol abuse will be presented as they both present as significant factors in the development of chronic disease. Individually, Canadian rates, annual financial costs of the disease, and prevalence in the workplace will be reported.

Chapter 4 provides background as to previous workplace wellness programs, their financial returns, and limitations. Future directions will also be focused on as it relates to physical activity and nutritional status in the workplace. Previously implemented wellness programs will be discussed, as well as their associated costs and return on investment.
In Chapter 5, the background on ACCELERATION is presented, followed by the thesis investigation (as part of the larger ACCELERATION program). Chapter 6 will provide a discussion of the economic evaluation of the ACCELERATION program. Finally, the document will conclude in Chapter 7 with a summary discussion of future research directions and limitations to the research.
Chapter 2: Introduction to workplace prevalence of chronic disease and associated costs.

The purpose of this chapter is to provide a brief introduction on absenteeism and presenteeism and the role chronic disease plays in the workplace.

2.1 Absenteeism

Work absence comes in many forms. Scheduled absences such as annual vacations and statutory holidays are easily managed and accounted for by employers and create minimal impact on a company's productivity. The impact of avoidable absences related to injury, illness and unscheduled missed days in the workplace is a critical factor in a company's overall economic well being.

Absenteeism refers to illegitimate absences which are avoidable, habitual, and unscheduled (4). These absences cause large disruption to the business, employer, and other co-workers. These absences are disruptive to work scheduling, productivity, and are costly to the organization and the economy. Absenteeism can be hard to quantify as the line between legitimate absence and illegitimate absence is difficult to define. The Labor Force Survey provides measures of time lost because of personal reasons that are categorized into avoidable vs. unavoidable absences. The Labor Force Survey data of absences per employee reason can then be analyzed to identify patterns and trends which indicate absenteeism rates and the effect it has on the company (4).

The financial costs of absenteeism are divided into direct and indirect costs. Direct costs constitute the benefits and income paid to the absent employee. This includes vacation, holiday, sick, and disability pay. Indirect costs are considered to have a greater impact on an organization's productivity and finances versus direct costs. Indirect costs include three main areas: decreased productivity, unexpected employer costs, and administration costs.

Decreased productivity and associated indirect costs include delayed project completions, training and orientating replacement workers, and the negative impact on staff morale. Direct financial costs include: overtime pay for covering employees, wage costs of replacement employees, and premium costs for insurance plans. Administration costs include using staff time to secure a replacement or re-assign other employees, as well as the time managing the control of absenteeism (5).
The Kronos and Mercer Survey (2012) found that significant productivity loss occurs as replacement workers are both less efficient (21%-29%) and more expensive (15%-44%) than the absent employee. This results in an overall annual gross profit loss of 23%-41% (5)(6). The Conference Board of Canada (2012) reported through a series of publications "Missing in Action; Absenteeism Trends in Canadian Organizations" that workplace absence rates directly cost the Canadian economy an estimated 2.4% of gross annual payroll or $16.6 billion, excluding the indirect costs of absenteeism (7).

2.1.1 Canadian Rates of Absenteeism

Sun Life Financials investigation, “Missing in Action” (2001), reported that in an average work week, approximately 7% of all full time employees were involved in unscheduled absence from work (6). By 2011, the number had risen to 8%. This equates to 8.5 days per worker in 2001 to 9.3 days in 2011 (4)(6). Absenteeism rates per province were also reported with Saskatchewan having the highest rates at 11 days, and Alberta at the lowest rate with 7.9 days missed per employee. British Columbia falls in the middle with an average of 10 days missed per employee (8).

Dabboussy and Uppal's “Working Absence” research showed that the public sector absenteeism rate was higher than that of the private sector at 12.9 and 8.2 days, respectively (8). It was also shown that absenteeism rates are highest in the health care/social assistance sector at 14 days per employee, followed by public administration at 12.8 days, and transportation and warehousing at 12.3 days (8). The reason behind these statistics is attributed to the high stress environment of these sectors, and the high susceptibility of employees to illness and injury (8).

2.1.2 Reasons for Absenteeism

There are many causes of avoidable absence which include, but are not limited to: injury, illness, low morale, lack of job satisfaction, inadequate leadership, poor co-worker relations, low physical fitness, chronic disease, poor nutritional status, stress, and excessive workload. Roughly half of all absenteeism is related to health and physical factors that impair an employee from attending work (9). The major diseases associated with absenteeism are obesity, cardiovascular disease, diabetes, cancer, excessive alcohol consumption, and smoking. The Public Health Agency of Canada (2009) reported that 9 out of 10 Canadians have at least one risk factor for heart disease or stroke (10). These risk factors include smoking, alcohol, physical inactivity,
obesity, high blood pressure, high blood cholesterol, and diabetes (10); and have been directly attributed to the physical inactivity rates and poor nutritional lifestyles of many Canadians. These risk factors also lead to increases in the likelihood of absenteeism in the workplace. The individual impacts of chronic disease will be discussed in further sections.

Most adults do not participate in enough weekly physical activity to achieve the international recommendations regarding 150 minutes of moderate-to-vigorous physical activity (11). According to the Canada Fitness and Lifestyle Institute, 40% to 65% of all Canadians are physically inactive (12). The BC Ministry of Health Services estimates that the physical inactivity costs on health care are approximately $211 million per year in direct costs (12). Implications of physical inactivity on absenteeism and the financial costs associated will also be discussed in detail in further sections.

2.1.3 Measuring Absenteeism

According to Statistics Canada there are three measures of absence: the incidence of absence, the inactivity rate, and the days lost per worker. The incidence of absence is expressed as a percentage of full-time employees reporting an absence in a given work week. The inactivity rate shows the hours lost in productivity taking into account both incidence and length of absence. Days lost per employee are calculated by multiplying the inactivity rate by the number of working days in a year.

The estimated number of working days annually is 250. This assumes that the average full time employee works five days/week and has approved time off for all statutory holidays, approximately ten a year. Given 52 weeks per year, at five days/week with 10 statutory holidays taken into consideration, this equates to 250 working days on average. With this annual average, days absent per worker can be calculated with higher precision (8). Based on the Wage-Gap Reduction Initiative's "Calculating Absenteeism, Retention & Turnover" the rates and costs of workplace absenteeism can be calculated (13). These calculations are shown in Appendix 1.

Companies struggling with unscheduled absences could potentially look at ways to improve the workplace productivity and morale through wellness programs that include professional development in physical activity, nutrition, and mental health. Research suggests that a more positive work environment and employee-employer relationship are related to a lower rate of absenteeism. The implementation of workplace exercise programs has been
reported as highly beneficial in the reduction of healthcare costs to both the organization and the economy, and shows positive improvements in employee quality of life.

2.2 Presenteeism in the Workplace

Presenteeism in the workplace is receiving increasing attention from employers concerned about the productivity and performance of their employees. It is directly related to absenteeism as workers who report higher incidences of presenteeism have a greater tendency to be involved in absenteeism (14). Presenteeism is addressed as an employee being at work but not functioning at their normal 100% working capacity (14). There are five main interacting elements of presenteeism: burnout, physical health, mental health, working distractions, and life distractions.

Burnout is the physical and psychological exhaustion of employees at work, with stress being a primary contributor. Physical health is characterized as employees at work but under-functioning due to physical distress which may include colds, flu, migraines, diabetes, cardiovascular disease, and musculoskeletal aches. Mental health is described as the influence of anxiety, depression, impaired decision making, and inability to concentrate which leads to under-functioning. Work distractions involve the impact that office politics, low workplace morale, difficulties with coworkers and supervisors, and job insecurity has on productivity. Life distractions refers to the interference of family problems, transportation issues, home environment, marital difficulties, and/or financial problems which cause preoccupation of employees while at work.

2.2.1 Canadian Rates and Costs of Presenteeism

Canada Life Group Insurance (2013) surveyed 150,000 employees in various work environments and found that 93% of staff self-reported coming into work when ill or injured at some point within a given work year (15). Of this 93%, 87% reported that the illness or injury impaired their working capacity and productivity during the working day (15). One study found that on a given day, 7% of workers were present at work despite health problems (16).

The high prevalence of presenteeism results in large scale productivity losses and massive economic burden annually. Statistics Canada (2012) reported that presenteeism related productivity losses are at least seven and a half times greater than the productivity losses due to absenteeism annually (15)(16). It is estimated that presenteeism costs the Canadian economy
between $15 to $25 billion dollars per year, compared to the $17 billion in costs from absenteeism (15).

2.2.2 Measuring Presenteeism

Presenteeism can be hard to quantify and measure as it is a subjective measure based on individual employee levels of productivity. However, there are survey tools that have been created to measure presenteeism. The most common is the World Health Organization’s Health and Work Performance Questionnaire (HPQ), the Stanford Presenteeism Scale (SPS), and the Work Limitations Questionnaire (WLQ). The HPQ is suited for smaller employers with 30 questions that focus on both absenteeism and presenteeism, wherein workers are asked to assess their own overall work performance during the past four weeks (17). The Stanford Presenteeism Scale is an efficient survey of six questions that focus on physical health, mental health, and job satisfaction that all directly relate to presenteeism. It is based on 5-point Likert self-reported scale that is scored into a percent of working capacity out of 100% (18). The WLQ consists of 25 questions which assesses how illness impacts an employee’s ability to function under job demands (17). All of these surveys have been validated, and been widely used across multiple work sites.

Due to its smaller questionnaire format, the SPS survey has been shown to be a reliable method in obtaining large population responses. Being a six question survey, employees are able to answer the questions quickly without having to feel subjected to intense scrutiny about their working habits that other presenteeism productivity questionnaires may have. The SPS was designed to better assess the impact of health related conditions on work-based knowledge tasks and production based duties (18). The SPS survey has shown strong internal consistency with excellent psychometric properties for assessing knowledge and production based jobs (18). The SPS also provides a scoring table and validated presenteeism cost calculation for annual expenditure per employee. Calculating annual presenteeism costs uses: the percent presenteeism (100% - self reported percentage of full capacity) x Annual Salary/Wages of employees (16)(18)(19).
2.3 Summary

The Canadian Economy each year spends billions of dollars on preventable absenteeism and presenteeism. The relationship between absenteeism, presenteeism, and chronic disease has been consistently reported in the literature. With an overall goal of increasing health status and reducing employer costs, workplace wellness programs have been shown to indirectly and directly affect absenteeism and presenteeism rates, and warrants further research efforts.
Chapter 3: Chronic Disease and the Workplace

This Chapter will review three major chronic diseases and the risk factors of smoking and alcohol consumption in the workplace.

3.1 Obesity

Obesity is a rising epidemic across the country with significant repercussions for the economy, companies, employers, co-workers, and individual health (11). Obesity is associated with lower health status, increased use of health care services and higher health care costs (20). In the workplace it is associated with higher losses of productivity, absenteeism, increased cost to the employer, higher disability claims, and can have a negative impact on staff morale (20). Evaluating the costs of obesity has become essential for any business.

Obesity has been linked to many chronic diseases such as: hypertension, type 2 diabetes, cardiovascular disease, cancer, and arthritis (21). Chronic disease substantially increases the financial burden on a company and the economy. Obesity can be assessed and categorized using the Body Mass Index (BMI) guidelines, which measure the relationship between weight and height and is defined as weight in kilograms divided by the square of height in meters (kg*m$^2$) (22). Using the BMI scale, those who fall in the categories 25-29, 30-40, and 40+ are considered overweight, obese, and morbidly obese respectively (23). It is important to note that the use of BMI scales are not always accurate in determining obesity prevalence as it does not distinguish between fat mass and muscle mass. Muscle mass weighs more than fat mass; therefore, using the BMI calculation, it can overestimate BMI scores in certain cases.

3.1.1 Canadian Obesity Rates

Using BMI guidelines, 41.3% of men and 26.9% of women in Canada self-reported weight and height measures that classified them as overweight or obese (23). Of those who were categorized as overweight or obese, 59.9% of men and 45.0% of women had additional health risks related to excess weight, which can lead to the development of other co-morbidity's and increased mortality risks (24). When examining provincial obesity rates, British Columbia demonstrates the lowest percentage at 14.1% of the population while Atlantic provinces report the highest obesity rates (Newfoundland and Labrador, 26.3% ; PEI, 26.1% ; and New Brunswick, 28.0%) (24).
Age is another factor that is associated with changes in BMI. Statistics Canada (2011) showed that age and weight demonstrate a positive linear relationship. Age was categorized into: 20-34, 35-50, 50-65, and 65+, and the correlating obesity rates were reported as 13%, 22%, 27%, and 18% respectively. It is important to note that obesity rates declined in 2011 after the age of 65 (24).

3.1.2 Obesity in the Workplace

Statistics Canada (2005) has reported that the rate of obesity has steadily increased, with the prevalence for men rising from 17% in 1999 to 21% in 2005 and for women rising from 12% to 14% over the same years (25). From the 2005 worker population, it is reported that two million employed Canadians were considered obese; this does not include those categorized as overweight. Given the rise in obesity since 2005, the number of obese employee’s is well over two million in Canada (25).

When looking at the prevalence of obesity in the workplace, the Gallup-Healthways Well-Being Index (2012) reported that the transportation industry had the highest rate at 36% and physicians were ranked lowest at 14% (25). Occupational Obesity rates are shown in the Appendix.

The increasing rate of obesity among Canadians can be attributed to a work and social environment that discourages physical activity, encourages excessive eating, and possesses a higher number of sedentary jobs (26). Factors that contribute to increased obesity and overweight workers include but are not limited to: shift work, irregular hours, excessive overtime hours, low education, heavy lifting, prolonged hours sitting, and high stress. High job stress is correlated to obesity and it has been shown that the impact of chronic stress on the body directly leads to increases in intra-abdominal fat deposits (27). With a high stress job comes unhealthy coping mechanisms such as overeating, increased alcohol consumption, decreased physical activity, and increased habitual smoking, which can all lead to obesity (28). Company morale and co-worker relations are also highly correlated to obesity due to increased psychological workloads in conjunction with a lack of social support (28).

When comparing white collar and blue collar occupations, obesity rates are much higher for men in the blue collar workforce. According to Stats Canada (2012), men (who work over 40 hours a week) demonstrate the highest obesity rates when engaged in sedentary work, shift work,
and high stressful jobs. Non-standard work schedules may make it more difficult for individuals to engage in a healthy lifestyle consistently. There is also a correlation between obesity and work performance. Obese employees have been reported to take 25% to 100% more sick days than normal weight employees (i.e., at 15 days versus seven days, respectively) (29). In the U.S., it is estimated that 39 million workdays are lost annually for obesity related reasons (30).

3.1.3 Cost of Obesity

Obesity is a costly disease as it often results in accumulated chronic illnesses that require frequent and long-term continuous use of health care resources. For example, it has been reported that obese employees were 40% more likely to visit a physician, and two and a half times more likely to take prescription drugs for cardiovascular and circulatory diseases (31).

In 2000, the average annual physician cost of overweight male and female adults was $427 and $578, respectively. Costs for the obese population were higher with males at $475 and females at $682, respectively (34). It has also been estimated that the total cost of physician appointments, hospitalization and day procedures for healthy weight, overweight, and obese adults are $690, $746, and $884, respectively (35). It is estimated that the increases in spending on obese persons relative to healthy weight counterparts accounts for over 27% of the rise in inflation per capita medical spending since 1987 (36).

In 2005, Statistics Canada published an analysis that estimated the total cost of obesity to be $4.3 billion with $1.8 billion in direct health care costs and $2.5 billion in indirect costs. It was also established that this figure underestimated the overall economic cost because quantifying absolute indirect cost is difficult (32). In 2012, the annual costs of obesity totaled to $11.1 billion, where both direct and indirect costs were accounted for (33). The total cost attributed to obesity and the associated negative health consequences has been estimated to represent 4% to 7% of national health expenditures, representing the value of lost productivity attributed to obesity and related co-morbidities (34).

3.2 Cardiovascular Disease

Heart and Stroke Canada defines cardiovascular disease (CVD) as the injuries and diseases that affect the cardiovascular system including: the heart, blood vessels, veins, and arteries of the heart. Stroke is the result of a blood flow impairment to the brain and is considered
a form of cardiovascular disease (27). Cardiovascular disease comes in many forms such as hypertension, atherosclerosis, coronary heart disease (CHD), valvular heart disease, myocardial infarction, arrhythmia's, and stroke. These all collectively contribute to the high mortality, morbidity, and economic burden rates in Canada.

There are a multitude of risk factors that are associated with CVD. Some of these factors are considered non-modifiable such as family history, age, and ethnicity or race. The modifiable risk factors are considered to have a greater impact on developing CVD. These include: hypertension, obesity, diabetes, poor nutrition, physical inactivity, smoking, excessive alcohol consumption, and high cholesterol (28). In 2010, it was estimated that over four million Canadians had at least two risk factors associated with CVD (27). According to the 2000 Canadian Community Health Survey, Canadians between 20-59 years of age self-reported their own modifiable risk factors. Of the 133,300 respondents, inadequate nutrition and physical inactivity reported highest at 64.7% and 55.6%, respectively. Smoking, high blood pressure, and obesity all reported at 25.6%, 18.3%, and 47.5%, respectively (29). Cardiovascular Disease presents a substantial burden to an individual, company, and the overall Canadian economy. It is widely acknowledged that CVD incidence is modifiable with proper nutrition, physical activity, and a positive workplace environment.

3.2.1 Cardiovascular Disease Rates in Canada

In 2003, approximately 80% of the Canadian population had at least one risk factor for CVD, with the main age group of 50-59 years old living with the highest number of risk factors. In 2008, 69,500 or 29% of all deaths in Canada were attributed to CVD with 67% attributed to ischemic heart disease or heart attacks, and 20.0% due to stroke (27)(29). The lifetime rates of CVD in men and women are similar. However, men tend to develop CVD earlier in their lifetime and are hospitalized more often than women. The mortality rates for men are highest between the ages of 40-55 years (31). Overall, the mortality rates between men and women are very similar (30). The Male: Female ratio of CVD prevalence has been shown to decrease with age from 5:1 (40-49 yr) to 4:1 (50-59 yr), to 3:1 (60-69 yr) and 2:1 (70-79 yr) (31). When examining annual prevalence of CVD between provinces, Ontario and Quebec report the greatest prevalence at 680,100 and 463,600, respectively. While British Columbia and the Maritime Provinces had the lowest reported prevalence of CVD at 137,400 and 102,000, respectively (31).
Cardiovascular disease risk of premature mortality has been documented as Potential Years of Life Lost (PYLL), which is calculated as the sum of the number of years of life an individual has “lost” due to premature death (i.e., premature death prior to the age of 75) (31). When examining PYLL (2000) results, Canadian citizens lost 277,100 years. This number was only exceeded by death due to cancer (31).

It has been reported consistently that there is an inverse relationship between physical activity and the development of CVD (32)(33). If each working Canadian could achieve the recommended daily level of physical activity and improve nutritional intake, myocardial infarctions and strokes could be reduced by as much as 36% and 20%, respectively (32)(33). This could increase life expectancy for all adults by a minimum of 1.3 years per person (33). In the United States, it is estimated that if every working citizen achieved the recommended levels of physical activity and followed nutritional guidelines, this would add 221 million life years to the population through avoidance of CVD-related events (33).

3.2.2 Cardiovascular Disease in the Workplace

With CVD being highly prevalent in Canadian society, the impact it has on the workplace is substantial and causes severe stress on business’ and Canadian economic health. Cardiovascular disease has a high association with workplace stress, most significantly in jobs that are considered high-demand-low-control work, effort-reward imbalance, and shift work (32)(33)(34). These jobs impart stressors on an employee that have been shown to reduce productivity as there is a diverting of employee attention away from work responsibilities and towards coping and addressing the stressors. This impairs job performance and creates further stress on the business, employee, and economy. Previous research suggests that approximately one in five shift work employees report living with at least three risk factors for CVD; while 17% presented with Type 2 Diabetes and 38% presented with high blood pressure (34)(35). Employees with fast paced, high strain/stress jobs are 38% more likely to experience a CVD event such as myocardial infarctions compared with those who work in low job stress environments (32)(28).

Socioeconomic status (SES) is another strong risk factor for CVD. Employees who are working in the blue collar and service industry fall on the lower end of the socioeconomic spectrum making them one of the highest risk groups in the Canadian workplace (28)(35). Lower
income, job status, education, and job satisfaction have all been associated with the blue collar workforce, and all attribute to the higher burden of CVD compared to higher-status counterparts (28)(35)(36). The main factors associated with a lower status job that affects the development of CVD includes: high job stress, job insecurity, sedentary work, irregular hours, and extended daily hours. Blue-collar workers and low-income workers are more likely to report increased alcohol consumption, smoking, inadequate nutrition, and low levels of physical activity (28)(35)(36).

The rates of absenteeism and presenteeism linked with CVD are directly associated to the number of risk factors an employee has. Absenteeism rates have been reported to be in a range from 6.3% - 25.9%, among employees who have up to eight risk factors (37). When examining 2,250 employees in a petrochemical company, Carnethon et al. (2009) showed the presence of zero, one, two, three, and four or more risk factors was associated with 4.1, 6.4, 8.8, 9.3, and 12.6 days of absenteeism, respectively (37).

### 3.2.3 Costs of Cardiovascular Disease in Canada

With the high prevalence of CVD in Canada, the financial burden of the disease continues to grow and place heavy stress on the Canadian Economy. Cardiovascular disease costs the Canadian economy more than $20.9 billion each year in hospital care, physician visits, absenteeism, presenteeism, lost wages, and reduced productivity (30). In 2000, the summed total cost of CVD was estimated at $22.2 billion, with $7.6 billion in direct costs and $14.6 billion in indirect costs. With the rise in costs of pharmaceuticals and hospitalizations this figure has only continued to increase (30). In the 2005/2006 fiscal year, CVD was the most common diagnosis for hospitalization, accounting for 16.9% of all admissions. Additionally, approximately 65.7 million prescriptions were dispensed for the treatment of CVD in 2005 (30).

In 2009-2010, Canadian hospitals managed approximately 3 million CVD cases, attributing for 18% of total hospital care visits in the fiscal year (27). When dividing CVD into sub categories based on hospitalization data, ischemic heart disease and stroke were the most common at 31% and 18%, respectively (27). The costs of hypertension drugs accounted for 50% of all CVD prescriptions written, with ischemic heart disease accounting for 29%. Acute Myocardial Infarction accounted for 33% of all CVD related mortality costs, and when combined with ischemic heart disease, this rose to 59% (27).
An estimated 25% to 30% of a company’s medical costs per annum are spent on employees with major CVD risk factors (38). With the implications of absenteeism and presenteeism alongside CVD, employees who reduce only one risk factor, decrease their absenteeism and presenteeism rates by as much as 2% and 9%, respectively (36). With this reduction, there is a reported change in productivity of 2% which can translate into a savings of $950 per employee per annum (36)(37). A meta-analysis of CVD and absenteeism showed (on average) a reduction in absenteeism, health care costs, and workers compensation through the implementation of workplace wellness programs by 28%, 26%, and 30%, respectively (36)(37).

From various reviews of job productivity and health care costs, it is estimated that health-related productivity losses cost US employers roughly $225.8 billion per annum, which divides into approximately $1,685 per employee (37)(39).

### 3.3 Cancer

Cancer is considered to be one of the leading causes of death in Canada, due to number of new cases continuing to increase with population growth and aging. While there are many types of cancer, the main categories identified by Canadian Cancer Statistics include: prostate, lung, thyroid, bone, breast, cervical, colorectal, melanoma, and non-melanoma cancers (40). The top four diagnosed cancers in 2012 were: lung, breast, prostate, and colorectal cancer (41). Cancer affects mainly those 50 yrs and older; however, diagnosis of cancer in younger patients has increased in the past ten years (41). Most cancers are the result of a multitude of risk factors that play coexisting roles in the development and growth of cancer cells. Risk factors include but are not limited to genetics, lifestyle, obesity, smoking and alcohol consumption, as well as excessive exposure to sunlight and toxic environment surroundings (40)(41).

Smoking is estimated to be responsible for or associated with 30% of all cancer deaths and 33% of diagnosed cancers can be linked to physical inactivity, poor diet, and obesity (40)(41). Modifying lifestyle choices to encompass eating healthier, participating in at least 150 minutes of physical activity a week, and reducing alcohol consumption and smoking in conjunction with working in non-toxic environments can reduce the development of cancer by about half (41)(42). Though the number of cancer diagnosis’ are increasing in Canada, the overall mortality rates have been steadily declining since the mid 1990’s as research and treatment therapies have increased and improved (40)(42).
3.3.1 Canadian Cancer Rates

Approximately two in five Canadians will develop cancer in their lifetime (41). In 2013, the Canadian Cancer Society estimated that 187,000 new cancer cases were diagnosed leading to 75,000 deaths. In British Columbia, it was estimated that approximately 23,700 new cases were diagnosed, leading to 9,700 deaths from cancer (41)(42). In 2009, approximately 2.5% or 1 out of 40 Canadians were living with cancer, or had been diagnosed within the past five years (41)(42). In the last ten years, cancer incidence rates have been increasing steadily with annual increases of 0.1% for men and 0.3% for women (40)(41).

More than half of all new diagnoses will be prostate, breast, lung, and colorectal cancer (41). Prostate cancer is the most frequently diagnosed cancer for men, while breast cancer is the most common diagnosis for women. In British Columbia, the number of new diagnoses in 2013 was estimated at 23,700 with prostate and breast cancer being the most common at 3,500 and 3,100, respectively. Even with prostate and breast cancer being more frequently diagnosed, lung cancer for both men and women claims the most lives at 1,250 for men and 1,150 for women per year. In British Columbia alone, an estimated 10,716 deaths in men and 9,490 deaths in women were cancer related (41)(43). The lifetime probability of developing cancer is 1.0 in 2.2 for men (46%) and 1.0 in 2.4 for women (41%) (42)(43). The probability of dying from cancer for men is 1.0 in 3.6 (28%) and for women 1.0 in 4.2 (24%) (42)(43).

When comparing cancer diagnoses between provinces, both incidence and mortality rates are highest in the Maritime Provinces and Quebec, while the lowest rates are found in British Columbia. Lung cancer has the highest reported incidence rate in Quebec. Colorectal cancer has the highest prevalence in Newfoundland and Prince Edward Island, while breast cancer demonstrates minimal variations between the provinces (42). Age is an important factor in the development of cancer with 69% of new cases and 62% of deaths occurring to those between 50-79 years of age (42). The incidence and mortality rates for males surpass females around age 55 (42)(43).

In 2009, Cancer was the leading cause of premature mortality representing 33% of the potential years of life lost (PYLL) when compared to 11 other premature death causes (43). Canadians lost an estimated 1,110,400 potential life years due to cancer. Lung cancer was responsible for 27% of premature death in all diagnosed cancers (43). When combining the three
leading cancer types: lung, colorectal, and prostate for men; and breast, lung, and colorectal for women, the PYLL was reported at 47% for men and 53% for women (43).

### 3.3.2 Cancer and the Workplace

Cancer has a significant impact on the economic workplace. The Canadian Cancer Society reports that in 2009, 24% of workers who had been diagnosed with cancer were unable to return to work due to cancer related health reasons and 9% had to quit within one year of return due to cancer related health issues that created significant physical and psychological obstacles (44). The most productive working years for employment are considered to be between 20 and 59 years of age. With 51,000 (27%) of all new cancer diagnoses occurring in this age group, the impact of cancer in the workplace is significant (45). The return to work (RTW) rates after cancer diagnosis varies with cancer type, treatment length, and leave of absence time. The majority of cancer survivors return to work within one year post diagnosis and on average work for an additional five to seven years until retirement (45)(46).

Typically the longest duration in workplace absence for cancer patients is from the time of diagnosis until three months post diagnosis. Approximately 85% of survivors were absent from work one year post diagnosis for four or more weeks (46)(47). In a recent study of RTW time and Breast Cancer survivors, two thirds of employees who developed breast cancer took more time off of work than that annually allotted by Employment Insurance (EI) (47). The average EI coverage allows for 15 weeks of absence, while a typical cancer treatment lasts for approximately 38 weeks (47)(48).

When returning back to work after treatment, 52% of survivors decrease their working hours, reduce workload, and/or have some changes in their daily responsibilities (46)(47)(48). Roughly 12% of survivors were unable to return to the same job function and salary because of medical issues, reassignment, company restructuring, and/or fatigue (48). Around 20% of RTW cancer survivors report limitations in ability to work from one to five years post diagnosis (46)(48). In addition, there are many work related changes that financially affect both the employee and employer. These challenges include: changes in job title, status, salary, working hours, reassignment of physical labour work, changing working pace to accommodate high fatigability of the employee, and reorganizing co-workers all which build up indirect and direct costs RTW (49).
3.3.3. Costs of Cancer

Over the next 30 yrs, it is estimated that 2.4 million Canadian workers will be diagnosed with cancer, with a potential 870,000 dying from the disease (50). Cancer costs the Canadian economy roughly $177.5 billion in direct health care costs, $199.0 billion in corporate profits, $250.0 billion in taxation revenue, and around $543.0 billion in wage based productivity (50)(51).

Recent US studies have estimated that cancer patients cost almost eight times as much to medically insure at approximately $30,000 per annum versus non-cancer patients at an estimated $4,000 per annum (51)(52). When looking at the costs of health coverage per month (2006), clients with cancer cost nearly $2,390 while clients without cancer cost around $360 (51)(52). Depending on the cancer diagnosed, the health insurance costs per month vary significantly. For example, breast cancer costs roughly $2,700, cervical cancers up to $3,500, and lung cancer costs the most at $8,000 per month (52). Therefore reducing the incidence of cancer through increased societal participation in wellness programs has the potential to provide significant reduced annual health care costs, with estimates of up to 50% of the current cost (52).

3.4 Alcohol

Alcohol is considered to be the most prevalent form of substance abuse found in the workplace with upwards of 10% of the labour force being classified as high risk, heavy drinkers (53). Excessive alcohol use, even when taking place outside the work environment, has significant effects on employers and the economy. The four main areas in which alcohol abuse has significant impacts on the workplace are: physical health, mental health, the social environment, and legal implications (54).

Physical health impacts include increased absenteeism, impaired performance, lowered productivity due to poor health, and fatigue. Mental health effects include increased anxiety, depression, and negative moods that impact others (53)(54). The social environment is affected through negative co-worker interactions such as the potential for multiple employees to partake in the abuse together, as well as costs to employers as the number of alcoholism related incidences increases. Last, legal implications refers to issues such as increased risk of injury and harm when employees are impaired, hung-over, or fatigued from drinking, and also includes potential criminal activities in the workplace such as theft (53)(55).
3.4.1 Alcohol Abuse in the Workplace

Alcohol abuse by workers is most commonly found with those involved in managerial positions and in blue collar employees (56). Those who are employed in the financial, oil, forestry, mining, and construction industries have the highest reported alcohol abuse frequency rates in Canada (56). Across Canada, surveys have shown that employee alcohol consumption at work ranges between 7% - 22% (55)(57). In Alberta, one in 10 workers (184,000 employees or 11%), report using alcohol while at work, with an additional 4% consuming alcohol within four hours prior to coming to work (53)(56).

The occurrence of alcohol abuse in the workplace has been found to be linked to those who travel long distances for work, working at remote job sites, working long extended hours with significant overtime, and work that involves the entertainment of clients and other businesses (56). Studies of alcohol abusers have shown higher prevalence of employees missing work, arriving late, and working at less than 50% capacity (56). In 2002, approximately 4 million hours of work were lost in Alberta due to reduced productivity and absenteeism totaling an estimated $74 million (56)(57). The rate of absenteeism is estimated to be four to eight times greater among alcoholics and alcohol abusers in the workplace when compared to non-alcohol employee absenteeism rates (54).

3.4.2 Costs of Alcohol Abuse

In 2002, the Canadian Centre on Substance Abuse reported that alcohol abuse cost the Canadian economy nearly $18.6 million due to absenteeism and $32.5 million in lost productivity, totaling $51.2 million (58). This equates to 2.7 million working hours missed in the 2002 fiscal year. This estimate did not include the costs of replacing missing workers, additional staff time, overtime to make up for lost productivity, workplace accidents, and medical costs linked to alcohol related injuries (56)(58). The most common reported employer costs that are associated with employee alcohol abuse are lost production due to absenteeism at 27%, cost of temporary workers at 18% and wages that are paid to absent employees at 15% of total annual company costs (56).

The estimated financial burden for alcohol abuse in the workplace is increasing steadily (56). In 2012, the Canadian economy lost nearly $923 million due to lost productivity caused by premature death associated with alcohol abuse, and spent approximately $62 million in workers
compensation due to alcohol, with an additional $6 billion lost in productivity due to long term
disability caused by alcohol (56)(58).

3.5 Smoking

Smoking is considered to be a leading cause of preventable death in Canada as it is
associated with many diseases such as cancer, heart disease, obesity, and high blood pressure. In
Canada (2013), it was projected that more than 37,000 Canadians will die prematurely due to
tobacco, and each day nearly 100 Canadians will die of smoking related illness (59). Smoking is
related to 85% of lung cancer diagnoses, which is the leading cause of death in Canada (60).

In 2004, almost 14,000 Canadians who smoked suffered from lung cancer compared to
only 361 non-smokers (61). Smoking increases the risk of developing heart disease and stroke as
it contributes to the build up of plaque in the arteries, increases blood clot formation, raises blood
pressure, and reduces the attachment of oxygen to haemoglobin in the blood. With these risks,
almost 9,300 Canadians over the age of 35 suffered from a heart attack when compared with 750
non-smokers (61). Chronic Obstructive Pulmonary Disease (COPD) is also highly associated
with smokers. Smoking causes progressive damage to the airways and lung tissues, and
manifests in respiratory symptoms such as coughing, wheezing, phlegm, and increased breathing
difficulties, all which are characteristics of COPD (61). The costs of a worker who smokes
compared to a non-smoker tend to be higher as there are associations between smoking,
increased absenteeism, decreased productivity, and increased insurance premiums (62).

3.5.1 Smoking in Canada

In 2013, 19.9% of Canadians, approximately 5.8 million self-reported as current smokers,
with 14.8% reporting daily smoking and 5.1% reporting non-daily smoking (59)(62). Males have
a higher smoking prevalence compared to women at 19.7% and 15.0%, respectively. Stated
differently, males are reported to smoke three more cigarettes a day when compared to women
(59)(60). The highest smoking prevalence in age categories was reported in the 25-34 and 20-24
age groups at 23.8% and 21.5%, respectively (59)(60). On average, Canadian smokers used an
average of 15.2 cigarettes per day, a decline of two cigarettes per day since 1999 (62).

Smoking prevalence between provinces is wide ranging with reports of approximately
23.8% of the Saskatchewan population self-reporting daily smoking, compared to the lowest
rates at 15.8% in British Columbia. The Northwest Territories reports the highest smoking prevalence rates at 35.0%, while the Maritime Provinces average 20.5% (62)(63).

3.5.2 Costs of Smoking

According to the Tobacco Report of Canada in 2012, the estimated economic impact of tobacco and smoking runs a financial cost of nearly $17 billion per year, with $4.4 billion in direct health care costs and $2.2 million in acute care hospital days (60). Smoking has a high prevalence and impact in the Canadian workplace with a range of 34%-52% of employees smoking daily (64). Those industries such as construction, mining, transportation, high labor intensive, and the oil industry have the highest rates of employed smokers. In the work environment, smokers take a higher number of sick days when compared to non-smokers at 14.3 days compared to the average 11.7 days (62). Each day, a total of 30 minutes of work productivity is lost by employees who take smoke breaks. Unsanctioned smoke breaks cost approximately $4,200 for a full time employee, a rise of 26% since 2005 (62)(64)(65). The costs of the extra two and a half days absence taken by smokers, totals approximately $414 per year per employee (62)(65).

When examining the loss in productivity, not including smoke breaks, it has been reported that current smokers are 6%-19% less productive than non-smokers in the workplace. This is potentially attributed to an inability to maintain physical activity levels that the job requires, changes in mental states that effect efficiency, and overall job satisfaction which is reportedly lower on average in smokers than non-smokers (66). By 2025, The Conference Board of Canada estimates that the prevalence of daily smokers in a typical Canadian business will fall by 35% if a workplace cessation program is presented. If a program is not introduced within the next few years, the prevalence rate is only expected to fall by 13% (65).

In sum, smoking is a leading cause of death in Canada and the impact in the workplace has been shown consistently to have high financial impact. By decreasing the prevalence of smoking in the workplace, there is potential for large reductions in annual health costs for both the employer and the Canadian economy.
Chapter 4: Physical Activity and Nutrition in the Current Workplace

The purpose of the chapter is to discuss briefly the current state and costs of physical activity and nutrition in the workplace and previous wellness programs that have been adopted into the workforce.

4.1 The Role of Physical Activity

Physical activity plays an important role in health benefits, quality of life, and both physiological and psychological well-being. Those who are more physically active tend to live longer, healthier, more productive lives while having lower reported rates of injury and illness. Physical activity has been shown to reduce the risk of more than 25 chronic diseases such as hypertension, Type 2 Diabetes, heart disease, obesity, depression, stroke, anxiety, breast and colon cancer, and osteoporosis (67).

The World Health Organization recommends that individuals achieve at least 150 minutes of physical activity weekly; however, research shows that doing only 10 minutes of exercise also has positive health benefits (67). The percentage of Canadian adults who are obtaining the 150 minutes by accumulating at least 30 minutes of moderate to vigorous activity on five days per week is only about 5% (68). The proposed 150 minutes can be achieved through a multitude of activities such as walking, running, swimming, bike riding, participation in sports among many other alternatives.

According to the Canadian Fitness and Lifestyle Research Institute, in 2000, roughly 61% of Canadians were deemed physically inactive, or were considered to be too inactive to receive the health benefits of regular daily physical activity (69). This rate of inactivity has decreased by roughly 10.0% in the past ten years. In 2005, engagement in 150 minutes of moderate to vigorous physical activity among Canadians was reported as 52% and increased in 2011 to 54% (71). Across the nation, physical activity levels range from a low of 33% in Nunavut to a high of 60% in British Columbia (71).

In Canada, physical inactivity is a significant factor in premature mortality rates from diseases such as cardiovascular disease, cancers, and Type 2 Diabetes with their respective mortality rates at 33.3%, 29.1%, and 3.5%, respectively (72)(73). In British Columbia, 15% of heart disease, 10% of hypertension, 14% of colon cancer, 19% of stroke, 11% of breast cancer, 16% of Type 2 Diabetes, and 18% of osteoporosis are linked with physical inactivity (68).
There are a multitude of physiological mechanisms that arise from regular physical activity that have been identified as possible factors in the reduction of chronic disease and premature death. With daily, moderate to vigorous activity, studies show that there is improved body composition through weight control and reduced abdominal adiposity, reduced cholesterol levels, improved glucose and insulin sensitivity, healthier blood pressure levels, decreased systemic inflammation, improved blood flow, and improved cardiac function, which all aid in the reduction of chronic disease risk (74)(75)(76)(77)(78)(79).

4.1.1 Costs of Physical Inactivity

In 2012, the financial burden on the Canadian economy attributed to physical inactivity totalled approximately $6.8 billion or 3.7% of the annual health care cost with $4.7 billion in indirect costs, and $2.1 billion in direct costs (80)(81). In British Columbia, physical inactivity costs the health care system approximately $211 million a year in direct costs such as hospital stays, physician appointments, and prescription drugs among other costs. Adding in the $362 million, in indirect productivity losses due to disability and premature death, the total annual financial spending in British Columbia that is associated with physical inactivity is estimated to be $573 million (82)(83). In 2009, the average inactive Canadian spent 38% more days in the hospital, had 6% more physician visits, 13% more specialist visits, and 12% more home nursing visits compared to an active Canadian (84). Reducing the prevalence of physical inactivity in British Columbia by 10% could save the economy approximately $50 million annually (84). In Canada, having a reduction in physical inactivity by 10% could potentially create annual savings of $150 million (84).

4.1.2 Physical Activity in the Workplace

With roughly 60% of waking hours spent at work, the importance of creating a physically fit and healthy environment in the workplace is paramount. The effect that physical activity has on the workplace is widespread, from increasing productivity, reducing absenteeism, and decreasing turnover rates to reducing disability, injury, and illness at work, as well as the overall company health care costs that are annually spent on health related claims (85). According to the World Health Organization, physical activity programs in the workplace can reduce sick leave by up to 32% and increase productivity by 52% (70).
The Public Health Agency of Canada reported that physically active employees take 27% less sick days and had reduced absenteeism rates up to 20% when compared to physically inactive employees (85)(86). BC Hydro estimates that their physical activity program has reduced sick leave costs by nearly $1.2 million a year (85). The number of injuries seen in the workplace can be reduced by 25% with physical activity programs implemented daily (85)(86). Physically active employees report 20%-25% fewer disability days as they tend to have fewer injuries, and employees injured who are physically fit are reported to recover faster and have a lower cost implication on the company (85).

While attempting to be active at work may be a challenge, incorporating simple strategies such as three, ten minute breaks where employees participate in brisk walks, or having walk-talk meetings instead of sit-down sedentary meetings can help in achieving increases in physical activity (67). Participating in simple activities such as standing at the desk while working rather than sitting, walking up a flight of stairs as opposed to using the elevator or escalator, walking during lunch breaks, or stretching during the work day all can help lessen the development of health risks and chronic disease (67).

### 4.2 The Role of Nutrition

A healthy diet that meets nutritional requirements can help reduce the risks of obesity, type 2 diabetes, heart disease, cancer, osteoporosis, as well as many other diseases. Nutrition is considered to be one of the most important factors in maintaining healthy lifestyle and preventing chronic disease and injuries. In Canada today, less than 10% of the population follows a diet consistent with Canada’s Food Guide recommendations (87). The result of improper nutrition on the Canadian workplace has high risk implications as the increasing prevalence of chronic disease will cause a lowering in labour force participation, leading to a high financial burden on the Canadian economy (87).

According to Health Canada (2006), five in 10 women and seven in 10 men exceed their daily recommended energy intake (88)(89)(90). Nearly 25% of the population have higher than recommended fat and carbohydrate intakes (88)(89)(90). In 2006, a reported quarter of Canadians are consuming more than 35% of their total calories from fat (the point at which health risks increase) (91). Sodium consumption is one of the highest risk factors associated with ill health. In 2004, 85% of men and 60% of women between 19-70 years of age had significantly
increased sodium intakes that exceeded the recommended upper limit (88)(89)(91). High sodium intake has been associated with heart disease, high cholesterol, and raised blood pressure.

On the opposing side of excessive nutrient intake, most Canadian adults have inadequate vitamin and mineral intakes. More than one third of Canadians in 2012 had less than adequate intake of major micro nutrients such as magnesium, calcium, potassium, vitamin A and D, and fibre (88)(92)(93). Fruits and vegetables are rich in vitamins, minerals, and fibre which are important for a healthy diet. In 2012, less than half of Canadians (40.6%) reported that they consumed the recommended intake of five or more servings of fruits and vegetables a day (88)(92)(93).

Excessive intake of fats and carbohydrates coupled with inadequate consumption of fruits and vegetables increases the risk of developing chronic disease. In 2007, 79% of all deaths in Ontario were attributed to chronic disease, of which 80% were associated with nutritional issues that caused diseases such as cardiovascular disease, cancer, and type 2 diabetes (94)(95)(96)(97). Through proper nutrition and physical activity, the risk of developing these diseases may be reduced (94)(95)(96)(97).

Canada’s Food Guide provides all Canadians with a guideline to healthy eating and lifestyle. With daily-recommended intake values for all four food groups along with micro nutrient intakes and guidelines to being active, Canada’s Food Guide has become a useful tool in helping individuals modify their daily diet to encompass all the proper nutrients needed in adequate amounts while reducing intake of sodium and saturated fats (98)(99).

### 4.2.1 Nutrition in the Workplace

Canadians spend roughly 60% of their waking hours at work and consume at least one meal in the workplace making it the ideal setting for promoting healthy eating (100)(101). The promotion of healthy eating can prevent absenteeism, decreased productivity, reduced medical and prescription drug costs, and lower the rate of injury, disability, and early retirement (100)(101). Employees that are eating at a higher health standard are more likely to be present at work, and exhibit higher productivity (100)(101).

Having a poor diet, with inadequate nutrient intake and high fat and carbohydrate intake in the workplace places a financial burden on the Canadian economy. The loss in productivity associated with morbidity from cancer, stroke, coronary heart disease, and diabetes are
attributable to diet, cost the Canadian economy an estimated $9.3 billion between 1997 and 2000 (102). Creating a workplace environment that promotes healthy eating options, time for eating breaks, and contains cafeterias and vending machines that offer options with reduced amounts of sodium, saturated fats, and heavy loaded carbohydrates is critical. Having social support groups that amplify the healthy eating lifestyle can also help reduce a company’s overall expenditure on health care and improve individual health (100)(102).

4.3 Previous Workplace Health Programmes

The workplace has been considered a valuable site for health interventions for a multitude of reasons including: the large amount of time people spend at work, access to large populations, engagement of populations that are otherwise difficult to access, and the opportunity to utilize employer incentives and social networks (103)(104). Using the workplace as the setting for interventions employers are able to see direct success through increased productivity, and reduced absenteeism and sick leave days, all which contribute to lower health care costs for the company and increased revenue (104)(105). The main targets that have been identified with successful workplace health initiatives focus on increasing physical activity and providing education on proper nutrition.

There have been many workplace health programs established in Canada and in the US, all with varying structures and pathways to achieving the same goal of enhanced employee/employer health. Many programs that have succeeded in the past achieved this through using a multi-faceted approach whereby interventions focused on physical activity, nutrition, smoking cessation, and alcohol consumption as a whole rather than as separate initiatives (103). By using a multi-faceted structure, there have been higher reported changes in employee physical fitness including lower BMI scores post intervention, improved dietary logging, reductions in weekly smoking, and lower monthly consumption of alcohol post study when compared to interventions that are single-faceted (106).

Of critical importance is the overall long-term behaviour maintenance, achievability, and generalizability to daily life that successful health interventions demonstrate with respect to adherence (107). Social influence and program education yield the highest results in terms of health improvements, decreased absenteeism and presenteeism days, and reduced sick leave (103)(105)(107). Therefore any multi-faceted initiative should have a social networking
component that includes family and friends who can gain access to health programs through the initiative and providing education that is related to the employee’s daily life, is easy to adhere, and can be maintained in the long term (103). From previous wellness programs that have been established those that use motivational enhancement approaches focusing on change over time by using tools such as motivational interviewing and the use of incentives and rewards showed the most promising results (103)(105)(107). Short-term changes in diet, physical activity, and health are important, but it is the long term changes that ultimately reduce the risk for developing heart disease, cancer, and diabetes (108).

### 4.3.1 Previous Workplace Study Attributes and Methods

In a recent systemic review of workplace interventions, a total of 43 peer reviewed papers were used to examine the effectiveness of workplace interventions on improving physical activity, nutrition and eating behaviour, and body mass index (BMI). Of the 43 papers, four categories of intervention focus were created, including: physical activity, eating behaviour, multiple health behaviours, and other. Of the 43 studies, 49% focused on multiple health behaviours, 42% focused on physical activity, 7% focused on eating behaviour, and 2% had a focus of other. The majority of the studies were from the US at 58%, with 14% from the Netherlands, 7% from the UK, and 5% from Canada, Australia and Sweden each (109). The number of participants was highly varied, with a range between 8 up to 10,281 based on company size. The average age distribution was between 32-50 years.

Effectiveness of the workplace interventions showed promising results. Of the 32 papers that focused on physical activity, 66% showed improvement (109). Of the 17 that focused on eating behaviour, 72% showed positive changes in daily diet and nutritional choices (109). In the 20 studies that focused on BMI and anthropometric measures, 41% reported positive change in BMI, and for the anthropometric measures of waist circumference, body composition and weight, there was reported positive changes of 75%, 80%, and 86%, respectively (109).

Various strategies were used to improve employee health. Physical activity focused interventions used tools such as pedometers, signs and prompts, peer management and support, and increased access to facilities and walking routes. Nutrition and eating behaviour studies used education, incentives, peer and management support, and increased access to healthy foods. The studies that focused on BMI and anthropometric measures, used pedometers, signs and prompts,
and peer/management support as tools in determining health status changes (109) (110) (111) (112) (113) (114).

Signs and prompts were displayed around the workplace, near elevators and escalators encouraging employees to use the stairway instead. Walking routes around the work site, increased facility access and walk-talk meetings were implemented with a high long term adherence and success rate of 78% (110)(112). The promotion of increasing physical activity when commuting to and from work was also seen to be a successful tool. Using this strategy, eight out of 14 papers showed a significant increase in energy expenditure and step counts as employees either walked or biked home or to work, or got off one to two stops earlier while riding on the bus (111)(112).

Eating behaviour interventions focused mainly on increasing intake of fruits and vegetables and a reduction in sodium and saturated fat consumption. Providing healthier food choices at work, in the cafeterias, vending machines, and during meetings showed an 89% increase in positive eating behaviours (109)(113)(114). Additionally, two studies reduced the costs of fruit and vegetable snacks in vending machines compared to high sodium, high sugar, and high fat content foods. This strategy showed a positive change in food choices, as more than half of employees reported buying the healthier option (114). Educational components were also included in most interventions, with a focus on food labelling, calorie intake limits, and grocery shopping help (109)(113)(114). Incentives such as gift certificates, days of paid leave, as well as kitchen gadgets and utensils were associated with positive changes in fruit and vegetable intake (109)(114).

4.3.2 Adherence and Attendance Rates

Glasgow and colleagues (1998) found that there is a significant fluctuation in participation rates, from a low of 8% to a high of 97% (115). Most studies from 2000 on report participation rates between 12%-89% (115), with highest participation rates coming from women, higher educated employees, married employees, those with job safety, employee in the age range of 25-55 years, and those in the white collar business sector (115)(116)(117). There were also higher participation levels in multi-faceted programs that offered incentives and rewards to employees (117)(118). There was a significantly lower participation rate in the blue collar work sector, employees who were from lower socioeconomic status, those who had shift
work and inconsistent schedules, and those interventions that required a fee to participate in (119)(120)(121).

4.3.3. Return on Investment

Return on investment (ROI) is a major component as to whether a company decides to implement a workplace health intervention. Workplace health interventions have been shown to be an effective method for increasing positive financial return through reducing employee related expenses such as absenteeism, presenteeism, disability days, and medical costs (123)(124)(125). Recent reviews on US worksite wellness programs found an average ROI of $3.48 per dollar invested in the health program. This figure is summed from reduced medical costs, a $5.82 ROI per dollar due to reduced absenteeism, a 25% reduction in sick leave days, and a reduction in workers compensation and health plan costs over a fiscal year post intervention (126). In Canada, the estimated financial returns through workplace interventions were defined by averted medical costs and increased productivity-related costs through a reduction in absenteeism. The average financial return ranged from $1.40 to $4.60 per dollar spent. Medical costs were found to decrease by $3.30, and absenteeism costs by $2.70 per dollar spent (124)(127)(128).

In a recent review of 21 workplace health programs (WHP), the total costs were dissected to show true ROI per fiscal year. In terms of participant costs, a range of $11 - $1075 with an average cost of $155 was reported based on one year participation (129)(130). Prior to the 21 WHP interventions, average absenteeism, presenteeism, and medical benefit costs in the companies’ most recent fiscal year were reported as $-113 to $1384, $2 to $1528, and $-82 to $554, respectively (130). Post WHP intervention, net balance (NB) costs averaged $91 per participant indicating a monetary gain after costs were covered (129). The Benefit to Cost Ratio (BCR) averaged 1.42 showing the amount of return per dollar invested which translated into a ROI average of 42.9% indicating the percent of profit per dollar invested (129)(130). One yr post intervention, the average ROI in terms of reduced absenteeism, presenteeism and medical benefits were reported as 200%, 246% and 22%, respectively. Out of the 21 interventions, 14 showed positive financial return (129)(130).

4.3.4 Limitations and Barriers of Previous Programs

While there has been a vast amount of positive changes shown in previous programs there are still limitations and barriers within these programs that can be addressed in future
interventions. It has been shown that being physically active at work is not always the easiest change to implement, as there are certain barriers that prevent this change. Approximately 42% of Canadian workers report that a lack of time is a key obstacle when trying to fit in physical activity (131)(132) as there are time pressures of a business that provide constraints for employees. Business productivity comes as a first priority, therefore when deadlines approach most employees will focus on finishing the business task and put physical activity low on priority. In many companies there is a lack of on site facilities such as change rooms, showers, bike racks and equipment storage rooms and fitness area’s or gyms that are easily available to employees at a reasonable cost (132)(133)(134). Approximately 26% of working Canadians indicate that the lack of nearby facilities creates a strong barrier to engaging in physical activity during working hrs (132)(134)(135).

Another significant barrier to change is creating workplace support through coworkers and especially management. There is evidence reporting that the cooperation or resistance of management to company health change is one of the single most influential factors when creating a workplace intervention program (136). Employees are less likely to engage and adhere to programs if they see that their superiors and upper management are not participating in the program as well. In 2004, Thompson and colleagues reported that of 19 previous interventions, only 10 had upper management participation. The nine that did not have the engagement of management showed significantly lower results of physical activity improvements, BMI changes, absenteeism reduction, and nutritional changes. (136).

4.4 Summary

With the rise of chronic disease in Canada creating an enormous impact on the financial stability of the economy, it is of utmost importance to promote physical activity, positive nutrition, smoking cessation, and a reduction in alcohol consumption in order to combat disease and reduce financial burden. Through out this literature review, it has been shown that employees who have low physical activity expenditures and poor diet in conjunction with smoking and alcohol consumption are at increased risk for chronic disease such as obesity, cancer, and cardiovascular disease. Absenteeism rates that are affected by employee chronic disease creates a massive financial burden on the economy. By improving overall health of the workplace, absenteeism rates and costs can be reduced significantly. Previous wellness programs
have shown promising results in reducing costs in disability days, medical costs, absenteeism rates, presenteeism rates, and sick leave days. Future programs need to focus on using a multi-faceted approach incorporating physical activity goals with nutritional education, seminars on smoking cessation and alcohol reduction while ensuring a company wide acceptance of the program to increase adherence rates and long-term maintenance of the program. A current multi-faceted approach framework has yet to be established; therefore future research programs should target framework development to best promote health and wellness in the workplace.
Chapter 5: The ACCELERATION Program and Thesis Investigation

This chapter consists of the background to Acceleration and the relationship to this thesis investigation.

5.1. Background to ACCELERATION

The University Health Network based in Toronto’s Rehabilitation Institute created a partnership with cancer and cardiac prevention and rehabilitation centers in Quebec, British Columbia, and Nova Scotia. This coalition aims to add new frameworks and knowledge to the existing chronic disease and cancer prevention interventions and initiatives through a multitude of programs. Specifically, the new ACCELERATION program, aims “to recruit family and friends of a people who have suffered an acute event associated with a chronic disease into a primary prevention program at the same time, their family or friend is going through secondary or tertiary prevention programs” (138). With this recruitment, ACCELERATION’s objectives are to use a population based approach to reach the at risk communities across Canada such as BC, Ontario, and Nova Scotia Cancer Agencies, Aboriginal communities, work sites, and YMCA programs in Quebec.

ACCELERATION is a 12 week prevention/intervention program that focuses on four common chronic disease risks factors: diet, physical activity, smoking, and alcohol consumption in a number of locations across Canada. It is a three year program, with the initial first year using traditional on site programs with the recruitment of more participants in years two and three through outreach programs. Across Canada, ACCELERATION aims to include 3,000 participants, distributed between four provinces. Expected individual outcomes for the program are increased physical activity, reductions in smoking and alcohol consumption, and a healthier nutrition lifestyle, with a main goal of measurably and effectively changing the risk factors and health behaviours known to influence the incidence of chronic disease.

5.2. Purpose of the Thesis Research

The purpose of this thesis was to conduct an economic evaluation on the 12 week ACCELERATION program administered in a British Columbia workplace site to determine
whether improvements in employee health status could be made, and the potential impacts the program had on employee absenteeism and presenteeism. It was hypothesized that:

(1) Workplace absenteeism rates three months post implementation of the ACCELERATION program will be reduced by 25.0-30.0%, reducing the current prevalence of 54.4% down to 40.8-38.1% and reducing the current average of 1.40 days to 1.05-0.98 days, cutting the current three month average cost from $272.78 per employee down to $190.95 - $204.59 creating a total savings of $68.19 – $81.83 per employee.

(2) Workplace presenteeism costs in a three months post intervention analysis will be reduced by 25.0-30.0%, creating a financial savings from the current average three month cost of $3890.95 per employee, down into a range of $2723.70 - $2918.22, a total savings of $972.73 - $1167.28 per employee.

5.3 Methods
5.3.1. Participants

Through partnerships with a major city in British Columbia, the ACCELERATION program was implemented with a target sample size of 100 workers, varied in occupation, length of contract, and annual salary. Staff members through the city were invited to attend a Health Fair for ACCELERATION whereby participants initially completed a Physical Activity Readiness Questionnaire for Everyone (PAR-Q+) and were then asked to complete a health assessment (138).

A total of 72 participants were recruited for the baseline health fair assessment, with five withdrawing from the program prior to baseline assessment, leaving the final participant number at 67, 23 males (44.9 ±10.5 yr) and 44 females (43.5 ± 11.5 yr). Participants recruited encompassed a range of occupations from administrative, clerical, technical support, community service workers, and management. Forty seven participants completed all 12 weeks of the ACCELERATION program and participated in the post program health fair and 50 participants returned both the baseline and follow up absenteeism and presenteeism surveys. The adherence rate from the start of the program till the end was 70%. The Participant Adherence Flow Chart can be seen in Figure 3. Participant job descriptions varied widely and can be seen Table 1.
There was no exclusion criteria for participants as all employees were considered eligible unless screened out by the 2014 PAR-Q+. This study was approved by the University of British Columbia Clinical Research Ethics Board and all participants provided written informed consent.
Table 1: Job Positions of Employees participating in ACCELERATION

<table>
<thead>
<tr>
<th>Job Position</th>
<th>Number of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive, Senior Management</td>
<td>9</td>
</tr>
<tr>
<td>Professional (engineer, accountant, systems analyst)</td>
<td>19</td>
</tr>
<tr>
<td>Technical Support (lab technician, legal assistant)</td>
<td>6</td>
</tr>
<tr>
<td>Upper Administration, Office Manager</td>
<td>21</td>
</tr>
<tr>
<td>Clerical (secretary, billing etc.)</td>
<td>4</td>
</tr>
<tr>
<td>Community Worker (Fire Fighter, Peace Officer etc)</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
</tr>
</tbody>
</table>

** 2 employees did not specify their job position

5.3.2 Health Fair Assessment

The basis of the health assessment was created by CLASP to target large population samples with clear and concise valid and reliable measurements. Measurements were chosen based on their ease of use while ensuring that each test had been validated to gold standard health measurements. Participants were cleared to partake in the health assessment by the PAR-Q+. Qualified exercise professionals (e.g., those certified via the Health & Fitness Federation of Canada) were present to clear those individuals wherein the PAR-Q+ identified a potential issue (138)(139).

The ACCELERATION assessment protocol consisted of the following measurements:

1. **Height** was measured to the nearest 0.5 cm with a 216 Accu-Hite Stadiometer.
2. **Weight** measured in pounds using a Tania Bioelectrical Impedence automatic scale, with the participant’s shoes removed.
3. **Waist circumference** (to the nearest 0.5 cm) using the top of the Iliac crest as anatomical landmarks. A standard tape measure was run around the circumference of the participant using these landmarks. Three measurements were taken and the average was calculated.
4. **Percentage body fat** was measured using a Tania Bioelectrical Impedance Scale. Participants took their shoes and socks off and then stepped onto the scale. Age, sex, and height were inputted into the scale for measurement.
5. **Resting Heart Rate and Blood Pressure** were measured using standard BpTRU Model BPM 100 automatic blood pressure cuffs. Participants sat for five minutes of rest, with their left arm on a table, palm in the supine position. Three measurements were taken and the average was calculated.

6. **Handgrip** was assessed with a Smedley Spring Dynamometer for the measurement of musculoskeletal strength as it has been widely accepted as a validated indicator of total body strength, and used as indicator of future functional limitations and health (140). Handgrip scores were used in the creation of individual resistance programs.

7. **Sit and Reach** was used to determine flexibility. It is a widely accepted population generalized test that specifically measures lower back and hamstring muscle flexibility and extensibility. Tightness in this area can implicate lumbar lordosis, forward pelvic tilt, and lower back pain. Results from the sit and reach test were used in the creation of individuals exercise programs with specific programs given where needed to increase participant’s flexibility.

8. **The Six Minute Walk Test** (6MWT) was administered to assess cardiovascular fitness. This test measures functional walking capacity and is a validated measure in assessing an individual’s ability to increase their activity level and maintain a moderate level of physical activity over an extended period of time (141). The 6MWT is widely used and accepted as a reliable cardiovascular measure with patients that have musculoskeletal impairments, pulmonary disease, and cardiovascular disease.

5.3.3. **The 12 Weeks of ACCELERATION**

Using the ACCELERATION education map, 12 weeks of health education were provided on a once a week basis, with an additional once a week exercise training session. Area’s of education that were targeted involved physical activity, exercise prescription and safety, goal setting, healthy nutrition lifestyle, stress and sleep effects on health, alcohol and smoking cessation, and how to plan for relapse and lasting behaviour changes. The ACCELERATION Program provided a one hour education session at the city hall of the respective worker, and a one hour exercise session each week with qualified exercise professionals (140). Each week CLASP resources were distributed to participants based on the week’s topic.
5.3.4 Individualized Physical Activity Programmes

Individualized exercise prescriptions were developed from the initial screening taking into account physiological measures such as heart rate response and rate of perceived exertion (RPE), handgrip strength, and flexibility scores from the health fair assessment. Progressions were made every three weeks following the F.I.T.T. principle of increased frequency, intensity, and duration to ensure participants continued to improve cardiovascular endurance and strength. The WHO guideline with a goal of 150 minutes of moderate-vigorous activity per week was used at the framework for progressing physical activity. Resistance programs used a variety of exercises combining free weights, rubber bands, and machines. Resistance programs included an exercise protocol that targeted major muscle groups, including: chest, back, legs, arms, and core. This program was created based on an individual's initial health assessment and their handgrip scores. The resistance program progressed in intensity by varying weight, sets, and reps every two weeks to ensure constant progress in muscular endurance and strength for participants. The cardioavascular and resistance training programs were based on the recommendations of Warburton and colleagues (141).

5.3.5 Nutrition Education

A registered dietitian conducted the nutrition education sessions. Goals were oriented around reductions in foods that are high in sodium, trans and saturated fats, and sugar. The consumption of five or more fruits and vegetables per day was encouraged and tracked with daily nutrition logs and frequent food questionnaires. Practical skills such as reading food labels, sensible shopping choices, and specific advice for those living with heart disease, cancer, and diabetes were available. Alcohol consumption goals followed the Canada’s Low-Risk Alcohol Drinking Guidelines, with limiting the weekly drinks for men and women to ten and fifteen drinks, respectively (142).

5.3.6 Goal Setting and Motivation

At the beginning of the 12 week program through an education session, participants were shown how to create SMART goals and given basic tools on how to intrinsically motivate themselves towards lasting health change. The SMART goals included setting specific, measurable, attainable, realistic, and time-managed goals. Each participant was given worksheets and resources to help them create proper goals for both short-term and long-term health changes.
These goals were revisited in weeks six and nine to identify any issues or problems, how to overcome any new barriers, and to continue progressing towards their goals.

5.3.7 Smoking Cessation

Education on the risks of smoking and resources to help quit were provided, with additional outreach programs of Smoker’s Helpline and public health programs readily available for participants. For those who requested extra help in smoking cessation, a seven day self-report on smoking abstinence was conducted with further help provided through individual counselling.

5.3.8 Questionnaires

Questionnaires focusing on employee demographics, absenteeism, presenteeism, physical fitness and health, mental health, sleep quality, and alcohol and smoking were distributed through Fluid Survey at the beginning of the program. Questionnaires used for the economic evaluation included the Workplace Absenteeism Scale and Stanford Presenteeism Scales. Both of these questionnaires are reliable and validated and have specific mathematical metrics that are used to create annual employee costs. The questionnaires can be found in Appendix 1.

5.3.9 Procedures

The ACCELERATION program was introduced to the worksite and online registration was opened to interested participants. All participants were invited to attend a Health Fair for ACCELERATION. Participants were also given access to an online survey platform to complete a series of questionnaires measuring different aspects of physical and psychological health, along side absenteeism and presenteeism prevalence. Participants had a two week timeframe to complete all baseline surveys before the health fair.

At the health fair, participants completed a Physical Activity Readiness Questionnaire for Everyone (PAR-Q+) and were then asked to complete a health assessment (138). The 12 weeks of ACCELERATION started immediately after the baseline health fair assessment. A follow up health fair was conducted a week after the conclusion of the three month program. Questionnaires were sent out 3 months after the follow up health fair (six months after the start of ACCELERATION).
5.3.10 Absenteeism and Presenteeism

The economic evaluation analysis was conducted using the Workplace Absenteeism Survey and the Stanford Presenteeism Scale. The Workplace Absenteeism survey was distributed to the participants at baseline and at the three month follow up point. The six questions were focused on the amount of entire or partial days an employee missed in the previous three months due to a physical or mental health issue compared to days missed due to other reasons such as family, emergencies, and vacation. Additionally, employees were also asked to indicate if these missed days were paid or unpaid. The Wage-Gap Reduction Initiative mathematical metric was used to calculate annual absenteeism costs (Appendix 1).

The Stanford Presenteeism Scale (SPS) workplace survey was distributed at baseline and at the three month follow up point. It is a six question survey that asks participants to indicate whether their mental or physical ailments are disrupting their working capacity and productivity. Reliability and validity for the SPS test was establish by Turpin et al in 2004. Using the SPS scoring table, employee working capacity was measured and used in to calculate annual presenteeism costs (Appendix 1). Furthermore, presenteeism costs were analyzed pre and post intervention using the validated math metric by Cooper et al. in 2008 for the Stanford Presenteeism Scale to determine any significant changes between baseline and follow up costs (Appendix 1).

5.3.11 Statistical Analysis

A total of 50 participants returned both baseline and follow up absenteeism and presenteeism surveys for the economic evaluation. Fifteen males (44.9 ±10.5 yrs) and 35 Females (43.4 ± 11.5 yrs) completed the 12 week ACCELERATION program and responded to the follow up survey. Based on previously published literature on absenteeism in the Canadian workplace, an effect size of 0.707 was obtained using G*Power Version 3.1.9.2. In order to obtain a strong power (0.80) a priori sample size calculations through G*Power analysis identified that 54 participants were required for the analysis (p=0.05).

Due to the non-normal distribution of absenteeism cost data, a Wilcoxon matched pairs signed rank test was conducted to determine whether there was a difference in baseline absenteeism costs and follow up absenteeism costs.
5.4 Results

Results of the analysis indicated that there was no significant difference in baseline costs ($m = 272.6 \pm 399.4$) and follow up costs ($m = 289.3 \pm 774.3$), $p<0.05$. A paired samples t-test was conducted to determine the difference in employee presenteeism costs at baseline and at the three month follow up. There was no significant difference in the scores for presenteeism costs at baseline ($m = 3798.5 \pm 3441.9$) and follow up ($m = 3496.6 \pm 3627.3$) time points; $t(49)=5.37$, $p=0.594$. These results suggest that participation in the ACCELERATION program did not have a statistically significant impact on changing individual absenteeism or presenteeism costs. Though the analysis reports no statistically significant changes in employee costs, the monetary cost savings from baseline to follow up were positive, as savings in both absenteeism and presenteeism were seen.

5.4.1 Absenteeism Results

The Workplace Absenteeism survey was distributed at both baseline and the three month follow up to measure the total amount of days employees missed during the three month study period due to absenteeism. Total average baseline absenteeism costs involving all 50 employees was $272.78. At the 3 month post program follow up the average absenteeism cost was $295.16 per employee. However this includes the three participants that suffered an acute injury post program which increased their absenteeism costs by $1333.42$, $2529.24$, and $3996.96$ respectively. With the definition of absenteeism being the chronic absence due to a chronic illness or physical disability, those with recent acute injuries are not within the absenteeism category. Therefore excluding these three participants, the average post program absenteeism costs was $116.99, yielding a total average costs savings of $155.79 per employee.

At baseline the reported average days missed per employee due to absenteeism was measured to be 1.40 days. At the three month follow up the average reported days missed per employee due to absenteeism was reduced to 0.64 reducing the number of missed days by 54%. Figure 4 depicts the average three month costs savings of the 20 employees who reported a reduced absenteeism rate at the post program follow up. Figure 5 represents the individual increases in absenteeism costs at the three month follow up for the eight employees that reported increases in absenteeism rate. The 32 female participants had a baseline cost average of $340 per
employee, and a follow up cost of $147.76 per employee, yielding a total average costs savings of $192.24. The 15 male participants had a baseline cost average of $116.40 per employee, and a follow up cost of $60.80, yielding a cost savings of $55.60. Statistical analysis revealed that neither genders’ baseline versus follow up costs had a statistically significant difference at the p<0.05 level.

Figure 4: Average Cost Savings per Employee based on Individual Reduced Absenteeism

![Average 3 Month Cost Savings per Employee based on Individual Reduced Absenteeism Rates Post Program](chart1)

Figure 5: Average 3 Month Increases in Absenteeism Costs per Employee

![Average 3 Month Cost Increases per Employee based on Individual Increases in Absenteeism Rates Post Program (8 Total Employees)](chart2)
5.4.2 Presenteeism Results

The Stanford Presenteeism Scale was distributed at baseline and at the three month follow up to measure the impact that chronic physical or mental pain has on employee productivity while at work. The six question survey targeted employees self reported ability to concentrate, complete tasks, handle stress, find pleasure in work, and perceived energy throughout the day. Working capacity out of 100% and presenteeism percent scores were then calculated. Using participant self reported annual salary and the measured presenteeism score, a three month employee presenteeism cost was calculated. At baseline, average working capacity of all 50 employees was 71%; thus measuring presenteeism at 29%. At the three month follow up, average working capacity rose 17% to 88% lowering presenteeism 17% to 12%.

Out of the 50 participants that returned the three month follow up survey 21 (42%) saw a reduction in cost, 15 (30%) showed no change from baseline cost, and 14 (28%) showed an increase in costs. Of the 15 participants that had no change, nine had a presenteeism cost of $0 at baseline. At baseline, average presenteeism costs per employee measured to be $3890.95. The post program follow up yielded average presenteeism costs of $3470.74 per employee, generating a total average cost savings of $420.12 per employee.

Of the 21 participants that showed a reduction in presenteeism costs, average cost change was $3806.25 per employee. The 14 participants that had an increase in presenteeism scores had an average increased cost of $4602.56 per employee. Three of these participants had suffered an acute injury after the completion of the 12 week program. Excluding these three participants, the 11 participants that showed an increase in presenteeism had an average increased cost of $4579.86. Figures 6 show the average presenteeism costs per employee at baseline and at the three month follow up.

The 32 female participants had a baseline presenteeism three month cost average of $3343.75, and a follow up cost average of $2928.38 per employee, yielding a total savings average of $415.37 per female employee. The 15 male participants had an average baseline presenteeism cost of $4177.77 and a follow up cost average of $4627.77 per employee. This yielded a total increase in cost of $450.00 per male employee.
5.4.3 Participant Health Changes and Results

i) Blood Pressure: The three categories of blood pressure were divided as: Normal (115-120/75-80 mmHg), Prehypertensive (120-140/85-90 mmHg), and Hypertensive (>140/90 mmHg). Of the 47 participants that were tested in both the baseline and follow up, 15 employees reduced their blood pressure, two had an increase in blood pressure, and 30 participants showed no change in their blood pressure. Figure 7 shows the changes in employee blood pressure categories pre and post program. There was a statistically significant difference in Systolic blood pressure from baseline (m =127.1±21.5) to follow up (m = 116.4±10.1) measurements; t(46)=2.14, p=0.04. Diastolic blood pressure was not statistically significant at the p<0.05 level.

ii) Body Fat Percent: Participants were placed into one of 3 Body Fat categories at both baseline and the three month follow up: Fitness, Average, and Obese. Sex differences were taken into account and participants were placed accordingly. Male participant revealed: two participants in fitness (14.0-17.9%), 6 participants in average (18.0-24.9%), and seven participants in obese (>25.0%). Female participant categories revealed: one participant in the fitness (21.0-24.9%) category, six participants in the average (25.0-31.9%) category and 23
participants in the obese (<32) category. Body Fat Percent did not show significant change between baseline and post program follow up. One female participant moved down from the obese category to the average category and one male moved from the average category into the obese category. Figure 8 shows the changes in employee categories based on Body Fat Percent. There was no statistically significant difference from baseline to follow up.

iii) Six Minute Walk Test and Predicted Maximal Aerobic Power: The maximal aerobic power (VO$_2$max) of the participants (evaluated via the six min walk test) was 21.5 mL·kg$^{-1}$·min$^{-1}$ and increased to 23.1 mL·kg$^{-1}$·min$^{-1}$ after the 12 week program (i.e, representing an increase of 1.57 mL·kg$^{-1}$·min$^{-1}$) (see Figure 9). Predicted VO$_2$Max values were not significantly different at the p<0.05 level.

iv) Handgrip and Sit and Reach: Handgrip scores from baseline to three month post program improved in both left and right hand scores. Left hand scores increased on average by 2.8 kg and right hand scores increased on average by 2.2 kg per employee. Figure 10 shows the average hand grip scores at baseline and post program. There was no significant difference in scores for Left Hand Grip at baseline (m = 35.8±1.2) and follow up (m = 33.7±1.4); t(46)=0.93, p=0.355. There was also no significant difference in scores for Right Hand Grip at baseline (m = 38.68 ±1.2) and follow up (m = 35.9±1.4) measurements; t(46) = 1.2, p=0.23.

Average employee Sit and Reach scores from baseline to the three month follow up showed improvements. At baseline, average employee scores were 23.3 cm, while at the three month follow up, scores improved to 26.5 cm, increasing average sit and reach scores by 3.4 cm. Figure 11 shows the average scores of sit and reach at baseline and post program. There was a significant difference in the scores for baseline (m=23.3 ± 9.2) and follow up (m=26.5 ± 9.6) time points; t(46)=-4.412, p = 0.00.
Figure 7: Employee Changes in Blood Pressure Pre and Post

*Changes in Systolic Blood Pressure were found to be statistically significant at the p<0.05 level. Changes in Diastolic Blood Pressure was not found to be statistically significant at the p<0.05 level.

Figure 8: Changes in Employee Body Fat Percentage based on Categories.

* There was no statistically significant difference between gender baseline and follow up scores at the p<0.05 level.
Figure 9: Average Employee Predicted Aerobic Capacity at Baseline and Follow Up

*There was no statistical difference between predictive VO$_2$Max values from baseline to 3 month post program follow up.

Figure 10: Average HandGrip Scores per Employee and Baseline and Post Program

Difference in predicted Hand Grip scores were not statistically significant at the p<0.05 level.
Figure 11: Average Sit and Reach Scores per Employee at Baseline and Post Program

*Difference in Sit and Reach scores were statistically significant at the p<0.05 level
Chapter 6: Discussion of the Economic Evaluation of the ACCELERATION 12 Week Program Based on Changes in Absenteeism and Presenteeism.

This chapter consists of a discussion of the economic evaluation of the 12 week ACCELERATION program based on employee absenteeism and presenteeism scores.

6.1 Absenteeism Evaluation

With roughly half of all absenteeism being related to health and physical factors that impair an employee from attending work, the ACCELERATION program looked to target these factors through weekly education and exercise sessions in hopes of directly improving employee health status and reducing individual health costs. Addressed each week were factors such as improving physical fitness, proper nutritional status, stress management, smoking and alcohol reduction, and injury and illness prevention. With absenteeism being an avoidable but costly limitation in the workplace, the need to combat it with workplace health programs is increasingly necessary.

The Workplace Absenteeism Survey was distributed at both baseline and at the three month follow up to measure the total amount of days employees missed in the past three months due to absenteeism. Out of the 50 participants that completed the post program absenteeism survey, 21 (42%) saw a reduction in their cost and 21 (42%) remained unchanged in their costs. However, it is noted that these participants reported both a baseline and follow up absenteeism cost of $0 and eight (16%) saw an increase in their absenteeism costs. Of those eight participants that saw an increase in cost, three participants sustained acute injuries after the program finished that impaired their working ability. Out of the 47 participants who completed ACCELERATION, the total average cost from baseline to three month follow up yielded a savings of $155.79 per employee.

Reduced absenteeism costs were shown by 21 out of the 50 employees that participated in the three month follow up. The average three month cost savings of these 21 employees was $132.40 per employee. Increased absenteeism costs was seen by eight employees, of which three indicated suffering an injury after program completion, which affected their ability to attend work during the three month post program phase. These participants showed individual increases in their absenteeism costs ranging from $1333.42 to $3996.96. Not including these
participants, the average increase in absenteeism costs of the remaining 5 employees was measured to be $135.95 per employee.

Male absenteeism at baseline yielded an average 3 month cost of $116.4 per employee. This cost was reduced by an average of $55.60 per employee during the three month post program phase, leading to a follow up cost average of $60.80 per employee. Out of the 15 male employees, three participants decreased their costs by an average of $582 per employee. Nine participants reported both baseline and follow up costs of $0. Two participants reported increased absenteeism costs from baseline with the average increased cost being $456 per employee.

Female absenteeism at baseline yielded an average three month cost of $397.11 per employee. These costs were reduced by an average of $249.36 at the three month follow up, leading to three month post program absenteeism costs of $147.75 per employee. Of the 35 female participants, 18 showed a reduction in absenteeism costs, an average savings of $503.70 per employee. Twelve employees show no change from baseline absenteeism costs of $0.60 employees showed an increase in absenteeism costs; however three of these employees sustained acute injuries post program thus negating their absenteeism costs. Of the remaining three female participants that showed increases in absenteeism at the follow up, their average costs measured to be $602.36 per employee.

The differences between male and female absenteeism rates have been shown previously in the literature. Statistics Canada (2011) reported that on average females were absent 3.7 more days than males for reasons due to illness and disability (137). Mastekaasa and Olsen (1998) found that female absence from work was higher than males even when both genders preformed apparently identical jobs (138). Reasons behind the increase in female absence has been hard to quantify although some researchers suggest that while women have a lower mortality rate than men, their morbidity rate is higher as women tend to suffer more from physical symptoms such as migraines, depression, and chronic illness, and have also been shown to make more doctor visits than men (139). However, in previous studies it was difficult to isolate sickness absence from other absence as the research may not take into account multiple reasons for employee absenteeism; thus, it is feasible that health dynamics may only account for some gender differences, not all. In this study, the absenteeism survey that was distributed attempted to
differentiate between health related absence and absence due to other circumstances such as family obligation, vacation, and emergencies.

Previous workplace health programs have reported positive economic benefit and return on investment through reduced absenteeism as well. Aldana and colleagues (2005) found that with the implementation of a comprehensive workplace health program, participants averaged three fewer missed workdays than non-participants and this reduced absenteeism translated into a cost savings of US$15.60 per dollar invested into the program (140). In 2010, an analysis of 22 US workplace wellness programs reported the impact on employee health care costs with an average savings of US$358 annually per employee, while costing the employer $144 per employee (141). Between the 22 programs, average absenteeism costs were reduced by US$294 annually per employee (141). Workplace wellness programs that have a comprehensive multifaceted on site approach have been shown to create a higher return on investment compared to online interventions and single faceted interventions (141).

Based on reductions in employee absenteeism, the 12 week ACCELERATION program produced a positive economic evaluation with a total average costs savings of $155.79 per employee. With the predicted costs savings prior to the start of ACCELERATION being $68.19 - $81.83 per employee, this cost savings of $155.79 is nearly double. While statistically, the economic evaluation did not yield significant results, monetarily these results show impressive positive benefits of the ACCELERATION program in reducing absenteeism costs.

6.2 Presenteeism Evaluation

With one in five Canadians experiencing some form of mental disorder in their lifetime, the effect of mental illness in the workplace has gained increased concern (144). Presenteeism has been shown to have higher economical costs annually due to losses in productivity and performance when compared to its absenteeism partner (144). While these costs cannot be altogether avoided, the losses in productivity due to poor health physically and mentally can be potentially alleviated through workplace health programs. Comprehensive and multifaceted programs such as ACCELERATION look to address the factors surrounding presenteeism through stress management sessions, and in the promotion of healthier lifestyles paired with physical activity and nutrition. In 2012, the Canadian Mental Health Association reported that the amount an employer can save annually through implementation of workplace health programs for employees that are receiving treatment for mental disability can be $5000-$10,000.
annually per employee in average wage replacements, sick leave savings, and prescription drug costs (145).

The Stanford Presenteeism Scale (SPS) was distributed at baseline and at the three month follow up to measure the impact that chronic physical or mental pain has on employee productivity while at work. The average working capacity of all 50 employees was 71%, measuring presenteeism at 29%. At the three month follow up, average working capacity rose 17% to 88%, lowering presenteeism 17% to 12%. At baseline, average presenteeism costs per employee were $3890.95. The post program follow up yielded average presenteeism costs of $3470.74 per employee, generating a total average cost savings of $420.12 per employee.

At the three month follow up, 20 participants reported a decrease in their presenteeism scores lowering their costs, 11 participants reported an increase in presenteeism increasing their costs, and 15 participants had no change from baseline presenteeism costs. Of the 15 participants that had no change, nine had a baseline presenteeism cost of $0.

Of the 15 male participants, four reported an increase in cost with an average of $5718.00 per employee, six participants reported a decrease in cost with an average savings of $2687.00, and five participants had no change in presenteeism cost from baseline. Of the 32 female participants, ten reported an increase in presenteeism with an average increase in cost of $3358.33 per employee. Thirteen participants reported a decrease in presenteeism with an average cost savings of $4413.71 per employee and nine participants had no change in presenteeism cost from baseline.

Presenteeism has long been a difficult phenomenon to quantify as it uses self-reported constructs rather than objective measurements. Dew et al. (2005) discussed how presenteeism was rationalized differently between varying work sites, occupations, positions within an occupation, and gender perceptions. While there are many reasons for presenteeism, Dew et al. noted that depression is one of the leading causes for workplace presenteeism (142). Kuoppala et al. (2005) and Reidel et al. (2001) both showed that exercise had a beneficial effect on improving presenteeism, although the type of exercise that elicits the biggest response is not known (142)(143). Kuoppala and colleagues identified that programs where support in supervised work site exercise, support in self-directed work site exercise, and specific interventions on mental health regarding depression in the workplace through outreach-treatment programs all improved presenteeism during follow up (142). Reducing the prevalence of mental health in the workplace
could potentially reduce the probability of further health issues developing, as mental health has been seen to influence the development physical and emotional problems.

A 2006 analysis of the effects of employee health, presenteeism, and workplace health by Burton and colleagues found that employee health problems at work lead to approximately 41 minutes of absence and 2 hours and 29 minutes of lost productivity each week per employee, which in any given work week amounted to more impaired time on the job than being absent from the job (144). According to the US Department of Labour report on Employees with Mental Health Impairments (2010), companies that implemented workplace mental health programs saw benefits in excess of $5000 in return in increased productivity, and employees diagnosed with depression (who took the proper management and medication) saved their employers an average of 11 days in prevented absenteeism (144).

Based on the reductions in employee presenteeism, the 12 week ACCELERATION program measured positive economic results, with an average total three month savings cost of $420.12 per employee. Predicted costs savings prior to the start of ACCELERATION being $949.61 – $1139.54 per employee were not met at the three month follow up; however, the economic results are still positive in savings. Future programs looking to increase this presenteeism cost could have a higher focus on workplace mentality, mental health, and workplace morale. The ACCELERATION program focused more on the physical and nutritional aspects of health compared to mental health, which could be a large attenuating factor as to why the cost savings are not as lucrative.

6.3 Attendance versus Cost

The majority of previous studies that have reported on the effects of health promotion programs on absenteeism rates show that those who participate in workplace health programs have lower levels of absenteeism compared to their non-participant counterparts, with an average reported reduction in absenteeism of 3.0%-16.0% (142). Increasing participation rates in workplace health programs can potentially improve employee health status and therefore improve employee health costs savings.

Average attendance of the 50 employees during the 12 weeks of the ACCELERATION education sessions was 43%. The 15 male participants attended on average 48% of all education sessions, while the 32 female participants attended on average 35% of the sessions. Attendance
at the education sessions showed a difference in employee absenteeism costs. Those participants who attended more than 50% of the education sessions had an average cost savings of $153.62 per employee, while those who attended less than 50% of the education sessions had an average increase in cost of $127.87 per employee. Attendance at the education sessions also showed a difference in employee presenteeism costs. Participants who attended 50% or more sessions had an average savings of $1543.85 per employee while those who attended less than 50% had an average cost savings of $1155.91 per employee.

Barriers to participation in workplace health programs are constantly being combated. The 47 participants that completed the health fair at both baseline and three month follow up were given a questionnaire that address factors that prevented 100% participation in the program. Barriers to participation were identified on a scale of Strongly Disagree to Strongly Agree. The top five barriers for participation are shown in Table 2.

Table 2: Barriers for Participation in the ACCELERATION Program

<table>
<thead>
<tr>
<th>Barrier for Participation</th>
<th>Number of Employees citing Agree / Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>10</td>
</tr>
<tr>
<td>I am already exercising therefore I do not need to do more.</td>
<td>18</td>
</tr>
<tr>
<td>Travel Conflicts</td>
<td>19</td>
</tr>
<tr>
<td>Time Constraints</td>
<td>31</td>
</tr>
<tr>
<td>Work Responsibilities</td>
<td>32</td>
</tr>
</tbody>
</table>

Previous workplace health programs that offered incentives and rewards reported higher participation rates compared to those that did not (117). Monetary rewards, gym memberships, and health store gift cards as incentives have all been shown to promote participation (117). A meta-analysis of participation in workplace health programs completed Baicker and colleagues (2010) reported that the majority of programs that had participation adherence above 50% used incentives in the form of bonuses, reimbursements for participation, and payback of down payments prior to participation (141). ACCELERATION offered no monetary incentives to participation, but gave participants complete health status reports at the end of the program with personal strategies and guidelines for the continuation of improving individual health status.
6.4 Employee Health Results

Overall health change through the ACCELERATION program showed improvements in multiple categories including reductions in blood pressure and waist circumference and increases in Predicted VO2Max and Sit and Reach.

Systolic blood pressure was lowered on average by 13.1 mmHg, while diastolic blood pressure was lowered on average by 4.6 mmHg. According to the UK Diabetes 2000 study by Adler and colleagues, a reduction in blood pressure by as little as 10mmHg has been associated with up to an 11% reduction in the risk of myocardial infarction and stroke (146). At baseline 27% of employees were categorized as Pre-Hypertensive and 23% were Hypertensive. At the three month post program follow up, 22% of employees were considered Pre-Hypertensive and only 9% were Hypertensive. The importance of systolic blood pressure as a predictor for cardiovascular risk was analyzed in a meta-analysis by Turnbull and Staessens et al (2003). Of 160,000 patients undergoing blood pressure treatment, they found that the odds ratio for cardiovascular outcomes and systolic blood pressure were highly correlated, and the reduction in cardiovascular event recurrence was attributed to the lowering of systolic blood pressure by a minimum of 7-14 mmHg (147).

Waist circumference (WC) was an additional measure that showed positive health improvements from baseline to follow up. At baseline 59% of employees were above the recommended health cut offs of >88cm for females and >102cm for males. At the 3 month follow up, waist circumference was lowered on average by 3.04 cm per employee, reducing the percent of employees above the health cut offs down to 46%. The relationship between WC and health outcomes is affected by multiple demographic variables including sex, race, ethnicity, age, and gender. However, the strength of WC as a predictor for cardiometabolic diseases such as diabetes and coronary heart disease remains strong, even outweighing BMI as a predictor for such illness (148).

The Six Minute Walk Test (6MWT) was used as the measure of cardiovascular fitness as it has been deemed a valid and reliable measure for the general population, elderly populations, and those living with chronic medical conditions. According to the Healthy Hearts Assessment (2010), this test corresponds to the moderate intensity exercise approximately at the first ventilator threshold, and therefore can be used in the determination of predicted VO2max scores. At baseline, employees walked an average distance of 626.8 m leading to an average predicted
VO₂max of 21.53 mL·kg⁻¹·min⁻¹ per employee. At the three month follow up, average distance walked was 651.2 m leading to a new average predicted VO₂max of 23.10 mL·kg⁻¹·min⁻¹. Male participants increased their predicted VO₂max from 24.7 mL·kg⁻¹·min⁻¹ to 25.8 mL·kg⁻¹·min⁻¹, while female participants showed little change in scores, with a change from 21.3 mL·kg⁻¹·min⁻¹ to 21.9 mL·kg⁻¹·min⁻¹. While scores for both genders are low on the fitness scale, the improvements demonstrated the potential for improved health status. With programs that have a higher focus on exercise regimes and personal fitness, these scores could potentially increase even further.

The Sit and Reach test is a common objective measure of flexibility of the lower back and hamstring muscles. It is a widely used and validated measure to assess tightness and implicated lumbar lordosis and forward pelvic tilt both of which can lead to physical disability (149). At baseline, average sit and reach scores were measured to be 23.3 cm per employee, and at follow up an increase of 3.0 cm was achieved bringing the average follow up sit and reach scores to 26.5 cm.

6.5 Conclusion

The ACCELERATION program showed promising results in both the improvements in employee health status and economic benefit. While the economic savings were not statistically significant, the objective monetary cost savings are positive with an average savings of $155.73 per employee in reduced absenteeism and savings of $420.12 in reduced presenteeism. Employee physical factors of health were also improved through the 12 weeks of ACCELERATION and provide promising results for long-term adherence to health change with the continuation of ACCELERATION into years two and three of the program.
Chapter 7: Future Directions of Workplace Wellness Programs and Study Limitations

This chapter consists of discussion around future directions for workplace wellness programs and limitations to the ACCELERATION study.

7.1 Future Directions and Limitations

The ACCELERATION program is a three year long-term project that will now extend out to family and friends of the recruited participants with a goal of primary prevention, increased awareness of health status, and readiness to change. The goal is to create a wide spread community support system that encompasses all participants and their families / friends. This future aspect of the program will be delivered through online resources, social networking, and virtual support groups whereby participants will have access to education materials, health coaching, motivational messaging, and experts in risk management.

Using the information gathered through the ACCELERATION program, modifications to future programs can be made to tailor specific needs to each new worksite. The ACCELERATION program included participants from a wide variety of job positions including administration, labour, and technical support. Therefore, future programs using the ACCELERATION framework could address specific groups of workers and measure the difference in impact the program has on each division. Job related health status is potentially very different between working divisions, such as shift workers, office administration or community service workers. As such, the effect that the ACCELERATION program could have on these individual working groups could be very different and possibly be more effective with one group versus another. Additionally, specifying between age groups, gender groups or inclusion of only those participants with chronic disease could also provide a deeper insight into ACCELERATION’s ability to alter health status and employee absence and productivity.

Future ACCELERATION programs could also increase the amount of resources available to participants. In this program, a once weekly education session with a once weekly exercise session was provided. The education session were run by a registered dietitian and a qualified exercise professional singularly, therefore potential improvements to the program could look at hiring resource experts in mental health, workplace psychology and team building, sleep quality, and health professionals amongst other areas, who could provide more in depth
knowledge on specific topics that are discussed each week through the program. The inclusion of multiple professionals could increase participant interest in the program and in turn potentially improve adherence and participation. With the objective of increasing presenteeism cost savings, future ACCELERATION programs could involve more sessions on mental health management and strategies to cope with workplace stress, as well as discussions at improving general workplace morale.

The major limitation to this study was sample size. The small sample size was not large enough to elicit a powerful statistical significance in the economic evaluation. The majority of previous workplace wellness programs have had over 300 employees participating; therefore future programs should look to widen the sample size. Using a larger work site, making participation mandatory for employees, or providing incentives to participants could potentially help attenuate the problem with a small sample size.

7.2 Conclusion

There are several reasons as to why employers can benefit from investing in programs such as ACCELERATION. These workplace wellness programs may lead to lower health care costs and health insurance premiums, increase productivity and workplace morale, and reduce the number of missed days and costs associated with such absences. Workplace health programs should look to target the psychosocial factors in addition to physical factors of the workplace in order to address both presenteeism factors as well as absenteeism factors in order to achieve the highest cost benefit savings. ACCELERATION showed positive cost savings in both absenteeism and presenteeism of $155.79 and $420.12, respectively. While these monetary savings were not statistically significant, they still provide positive savings for the participating workplace. The first hypothesis that ACCELERATION would save on average $68.19 – $81.83 was met, and the average cost of absenteeism at the post month follow up was reduced from the average $272.78 to $117.92 per employee. Additionally, absence days due to health problems were reduced 54% from the baseline average of 1.40 days to 0.64 days per employee, this exceeded the first hypothesis projection of reducing absence days down to 1.05-0.98 days. The second hypothesis of reducing presenteeism costs by $972.73 - $1167.28 was not met; however the reductions in costs of $420.12 were still positive in the monetary economic evaluation. Presenteeism was reduced 17% compared to the hypothesized 25%-30% at the three month
follow up. Therefore the ACCELERATION program hypotheses’ of reducing absenteeism and presenteeism individually by 25%-30.0% can be partially held but not fully accepted.
References

http://dx.doi.org/10.1161/circulationaha.109.192653
40. PHAC (2013). Chronic Diseases – Cancer Stats in Canada.


APPENDIX

Math Metrics:

1) Presenteeism

Costs of Presenteeism = \[\text{Percent presenteeism} \times \text{Annual Salary/Wages of employee} \times 4\]


2) Absenteeism Calculation Part 1

<table>
<thead>
<tr>
<th>Table 1: Calculating Absenteeism per Employee in a Fiscal Year based on Wide-Gap Reduction Initiative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total paid and unpaid sick days (all employees) _______________________________________________________________________________ =</td>
</tr>
<tr>
<td># of employees in the 12 month period</td>
</tr>
<tr>
<td>Total paid /unpaid days for leave for other reasons (all employees) _______________________________________________________________________________ =</td>
</tr>
<tr>
<td># of employees in the 12 month period</td>
</tr>
<tr>
<td>Total # of employees that took 5-20 days sick leave _______________________________________________________________________________ x 100 =</td>
</tr>
<tr>
<td># of employees in the 12 month period</td>
</tr>
</tbody>
</table>
3) Absenteeism Calculations Part 2

Table 2: Calculating the Costs of Absenteeism based on Wide-Gap Reduction Initiative

A.

\[
\text{Sum of all Cost per employee for sick days} = \text{Total annual cost of paid sick days taken}
\]

\[
\text{Total \# of paid sick days per employee} \times \text{Cost of absent employee per work day (Hourly rate} \times \text{Hours worked per day)} = \text{Cost per employee for sick days}
\]

B.

\[
\text{Sum of all cost per employee for paid absenteeism} = \text{Total annual costs of paid absenteeism}
\]

\[
\text{Total \# of paid absenteeism days per employee} \times \text{Cost of absent employee per work day (Hourly rate} \times \text{Hours worked per day)} = \text{Cost per employee paid for absenteeism days}
\]

Stanford Presenteeism Scale (SPS-6): Health Status and Employee Productivity

**Directions:** Below we would like you to describe your work experiences in the 3 past months. These experiences may be affected by many environmental as well as personal factors and may change from time to time. For each of the following statements, please circle one of the following responses to show your agreement or disagreement with the statement in describing your work experiences in the past month.

**Please use the following scale:**

Circle:
1. If you strongly disagree with the statement
2. If you somewhat disagree with the statement
3. If you are uncertain about your agreement with the statement
4. If you somewhat agree with the statement
5. If you strongly agree with the statement

<table>
<thead>
<tr>
<th>Statement</th>
<th>Your Work Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Because of my (health problem), the stresses of my job are much harder to handle</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>2. Despite having my (health problem) I was able to finish hard tasks in my work</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>3. My (health problem) distracted me from taking pleasure in my work</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>4. I felt hopeless about finishing certain work tasks due to my (health problem)</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>5. At work, I was able to focus on achieving my goals despite my (health problem)</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>6. Despite having my (health problem), I felt energetic enough to complete my work</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>
Absence Work Scale: Health Status and Employee Attendance

1. In the past 3 months, how many days did you miss an entire day of work because of problems with your physical or mental health?

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1-2</th>
<th>3-4</th>
<th>5-6</th>
<th>7-8</th>
<th>9-10</th>
<th>10-11</th>
<th>11-12</th>
<th>Over12</th>
</tr>
</thead>
</table>

2. In the past 3 months how many days did you miss an entire day of work because of any other reason? Family emergency, vacation, paid holidays, etc.

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1-2</th>
<th>3-4</th>
<th>5-6</th>
<th>7-8</th>
<th>9-10</th>
<th>10-11</th>
<th>11-12</th>
<th>Over12</th>
</tr>
</thead>
</table>

Were these days paid or unpaid?
PAID
UNPAID

3. In the past 3 months how many days did you miss part of a work day because of problems with your physical or mental health?

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1-2</th>
<th>3-4</th>
<th>5-6</th>
<th>7-8</th>
<th>9-10</th>
<th>10-11</th>
<th>11-12</th>
<th>Over12</th>
</tr>
</thead>
</table>

4. In the past 3 months how many days did you miss part of a work day because of any other reason?

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1-2</th>
<th>3-4</th>
<th>5-6</th>
<th>7-8</th>
<th>9-10</th>
<th>10-11</th>
<th>11-12</th>
<th>Over12</th>
</tr>
</thead>
</table>

Were these days paid or unpaid?
PAID
UNPAID

5. In the past 3 months, have you been involved in a work accident that resulted in you missing part of or an entire day of work? Yes/No (If yes please circle how many days were missed)

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1-2</th>
<th>3-4</th>
<th>5-6</th>
<th>7-8</th>
<th>9-10</th>
<th>10-11</th>
<th>11-12</th>
<th>Over12</th>
</tr>
</thead>
</table>
Demographics Questionnaire:

1. When is your birthday (dd/mm/yr.) __________________

2. Are you: Male / Female (circle one)

3. What is your current marital status?
   a. Married or cohabiting
   b. Separated
   c. Divorced
   d. Widowed
   e. Never Married

4. How many children do you have?
   a. None
   b. One
   c. Two
   d. Three
   e. Four or More

5. What is your estimated height? _______ Feet _______ Inches

6. What is your estimated weight? _______ Pounds

7. If you currently working or are on sick leave, please choose the category that best describes your main job. If none of the categories fits you exactly, please respond with the closest category. (Circle only one number.)

   1. Executive, administrator, or senior manager (e.g., CEO, sales VP, plant manager)
   2. Professional (e.g., engineer, accountant, systems analyst)
   3. Technical support (e.g., lab technician, legal assistant, computer programmer)
   4. Sales (e.g., sales representative, stockbroker, retail sales)
   5. Clerical and administrative support (e.g., secretary, billing clerk, office supervisor)
   6. Service occupation (e.g., security officer, food service worker, janitor)
   7. Precision production and crafts worker (e.g., mechanic, carpenter, machinist)
   8. Operator or labourer (e.g., assembly line worker, truck driver, construction worker)
8. How many hours are you contracted to work in a typical 7-day week? If it varies, estimate the average.

______________________________________ Hours/Week

9. How many hours do you usually work in a typical 7 day week? If it varies, estimate the average.

______________________________________ Hours/Week

10. What is your hourly wage pay? $_____________/hr. (if you are on salary pay, please estimate hourly wage)

11. What is your annual income from your job, before taxes? (Circle the letter)

   a. $1 - $10,000          h. $70,000 - $80,000
   b. $10,000 - $20,000     i. $80,000 - $90,000
   c. $20,000 - $30,000     j. $90,000 - $100,000
   d. $30,000 - $40,000     k. $100,000 - $150,000
   e. $40,000 - $50,000     l. $150,000 - $200,000
   f. $50,000 - $60,000     m. $200,000 - $300,000
   g. $60,000 - $70,000     n. $300,000+

12. How long have you been at this current job? Please specify in months and years.

______________________________________________
4) Stanford Presenteeism Scale Calculation Scoring Sheet.

<table>
<thead>
<tr>
<th>Questions</th>
<th>1, 3, 4 (scores)</th>
<th>2, 5, 6 (scores)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disagreed completely</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Disagreed to some extent</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Uncertain</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Agreed to some extent</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Agreed completely</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

Score: /30
Score is then divided to get percent of working capability = percent presenteeism score

**Presenteeism Costs Calculation:**
Percent presenteeism (100% - self reported percentage of full capacity) x Annual Salary/Wages of employee