Impact of the Wellness Fitness Program on Employee Absenteeism: A Study of Prince George Fire Rescue: 2005-2011

by

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Abstract

Workplace wellness programs have been gaining popularity in many private organizations as a corporate strategy. The implementation of wellness fitness into the public sector has been a slower transition. Literature shows that the implementation has the potential to influence and improve various organizational factors such as absenteeism. The purpose of this project is to evaluate the hypothesis that the Prince George Fire Department Wellness Fitness program has reduced absenteeism. This project looks at the three possible categories of absenteeism and evaluates whether they have been reduced since the implementation of this program. The results found are that post Workplace Wellness implementation participants have less absenteeism.

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CPAT	Candidate Physical Ability Test
IAFF	International Association of Fire Fighters
NFPA	National Fire Protection Association
PGFD	Prince George Fire Department
WWP	Wellness Fitness Program
WHPP	Worksite Health Promotion Program
BMI	Body Mass Index
SCBA	Self Contained Breathing Apparatus
CCHS	Canadian Community Health Survey

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Chapter I

Introduction

Worksite health promotion programs have emerged as an important part of corporate strategy aimed at improving employee health and productivity (Goetzel et al., 1998). The emergence of worksite health promotion as a mainstream human-resource strategy has been supported by recent literature reviews focused on the health and economic effects of these programs. Health-related work productivity losses may occur through either absenteeism (time missed from the workplace) or presenteeism (days at work but limited in performing job tasks because of health). Results from scientific randomized trials suggest that providing opportunities for individual risk reduction is crucial, especially for high-risk employees (examples include first responders – fire, ambulance and police). A review of 47 peer-reviewed studies found that a worksite-health-promotion program (WHPP) has substantially reduced health-care costs, as well as absenteeism and the disability of employees (Heaney and Goetzel, 1998, Pelletier, 1993). Employers who embrace a culture of wellness in their workplaces can also benefit in terms of health-risk modification, reduced employee absenteeism, reduced employee turnover and enhanced productivity.

In the private sector, one of the earlier adopters of the Workplace wellness promotion program was the Johnson & Johnson's program, the LIVE FOR LIFE worksite health promotion program which was initiated in 1979

(Ozminkowski et al, 2002). Consequently, large private sector firms such as DuPont, Bank of America, Tenneco, Procter & Gamble and recently Google have adopted similar programs with varying degrees of success. The public sector has been slower to respond and adopt these newly supported initiatives. Recent 911 incidences have brought into focus how the external work environment can amplify health risks and result in strain on the system. These first responders in the community (firefighters, police, ambulance) have been receiving increased media attention because of the escalated work-related injuries both physical and emotional. These injuries have caused considerable absenteeism, presenteeism and consequent escalation of cost and strain on the public system. Authorities have responded to these challenges by initiating a number of mitigating measures, which include worksite health and wellness programs. The impact or effectiveness of a program (such as labor-market programs or WHPP) is analyzed under the literature of "average treatment effects" (Lalonde, 1986; Dehejia, 2005; Imbens & Wooldridge, 2009). The methodologies used in the retrospective program evaluation of WHPP suffer from a lack of control of confounding variables such as age and sex (Mattke et al., 2007). The present study contributes to the literature by examining the impact of WHPP in Prince George Fire Department for the period 2005-2011 using data of various measures of sick hours of 105 firefighters.

The Prince George Fire Department (PGFD) consists of 105 full-time career members. The department is comprised of 4 halls and protects an area of 316 square kilometers. The City of Prince George has an estimated population

of 75,568 occupants residing within the city boundaries (Statistics Canada, 2007; BC Stats, 2011). The fire halls operates on a 4-shift rotation with halls having anywhere from 4 – 6 career firefighters, on duty 24 hours a day, 7 days a week. The shift schedule is composed of 2x10-hour days followed by 2x14-hour night shifts, then followed by 72 hours off. Over the last 8 years the PGFD has averaged nearly 5000 calls per year. The tasks completed by the fire department involve medical and fire emergencies, vehicle extrication and various specialty rescue operations.

The majority of tasks conducted by firefighters contain a physical element. The physical aspect of firefighting puts physiological strain on nearly every system in the body (Smith, 2011). These physical requirements necessitate firefighters to be sufficiently fit in order to perform the job adequately and safely. During the hiring process, all candidates are required to pass the candidate physical ability test (CPAT) and a physical examination by a doctor to ensure they have sufficient fitness levels to conduct the tasks associated with firefighting. Firefighters enter the fire service as healthy individuals, but they do not necessarily maintain this attribute over time due to various career experiences (Rosenstock & Olsen, 2007).

To assist in mitigating the negative side effects of fire department work and assist fire fighters in maintaining improved fitness, the PGFD has implemented a Workplace Wellness program (WWP) that is outlined in the National Standard for Fire Fighters (NFPA 1583). The NFPA standards were

developed to improve safety for fire hazards and people internationally. NFPA 1583 specifically deals with mitigating health effects on fire personnel (National Fire Protection Association, 2000).

In other departments the WWP has improved firefighters' health by reducing premature musculoskeletal injuries and cardiovascular disease through health screening (National Fire Protection Association, 2000). Other industries that have implemented Wellness programs have experienced reductions in health-care costs, loss of time and employee turnover after implementing a compressive fitness program (Gebhardt & Crump, 1990; Parks & Steelman, 2008). The study is organised as follows: chapter II provides a critical review of literature, Chapter III discusses the database and methodology, Chapter IV presents the empirical results and Chapter V presents the conclusions.

Chapter II

Literature Review

Wellness fitness programs have become extensively used in organizations around the world to help reduce organizational costs. Copious amounts of literature exist regarding the use of these programs in both the private and public sectors. The public sector has been a late entrant into this strategy but is now implementing it in several areas. It is estimated that programs designed to improve health and well-being are found in 80 to 90% of American work places (Aldana et al., 2005). Workplace health promotions are diverse in comprehensiveness, implementation intensity and strategy (Heaney & Goetzel, 1997). Many different styles of workplace health promotions exist, but the specific type looked at for the purpose of this paper was a wellness-fitness oriented program.

The following literature review will be structured as follows. The first section is a review of literature regarding the use of and arguments for workplace wellness programs. Section 2.2 is a summary of various case studies where wellness programs have been implemented into public and private workplace environments. Section 2.3 covers Canadian case studies of wellness fitness or health promotion programs. The concluding section 2.4 covers literature specific to wellness programs and firefighting.

Section 2.1 Arguments for Wellness Programs

Substantial evidence exists that supports the use of wellness programs for multiple beneficial purposes. Fitness wellness type programs have been found in numerous studies to have economic incentives including, but not limited to reducing absenteeism, injury, health care costs and turnover; they have also been shown to increased job performance, productivity, moral, team building and retention (Baicker, Cutler, & Song, 2010; Watson & Gauthier, 2003; Gebhardt & Crump, 1990).

In addition, wellness programs treat ailments such as heart disease, respiratory disease, back pain, diabetes and depression; these ailments amounts to huge costs in the order of billions of dollars from medical diagnostics treatment, decreased productivity and absenteeism (Gebhardt & Crump, 1990). Physical activity is particularly pertinent as a reducing factor in cardiovascular disease (Simons-Morton et al. 1998).

Medical costs have been increasing rapidly and are expected to double every 5 years (Mattke et al., 2007). The cost of providing health care has been increasing at a rate that is reducing the competiveness of many American organizations in regards to the global economy (Loeppke et al., 2007).

Some illnesses, such as back pain account for a significant portion of these medical costs due to their prevalence in the work force (Mattke et al., 2007). Organizations are implementing wellness programs to combat increasing

health-care costs. The employer's strategy thus involves early intervention and prevention of employee health problems and leads to decreased health issues and increased productivity.

Illness in the workplace can result in decreased productivity, which is derived from two sources: absenteeism and presenteeism (Cancelliere et al., 2011). Absenteeism is defined as loss of time from work (Campo & Darragh, 2012). The cost of absenteeism is a common incentive for the implementation of wellness programs due to both direct and indirect costs (Proper et al., 2002; Smith et al., 1990). The strategy is to increase employees mental and physical fitness, which in turn leads to healthier employees experiencing decreased absenteeism and health-care costs (Baicker et al., 2010).

Presenteeism is a highly common and costly factor for organizations. It can be defined as presence at work with a decreased capacity in some aspects of job performance due to health problems. Presenteeism is thought to cause a larger productivity loss than absenteeism (Mattke et al., 2007; Campo & Darragh, 2012). Workplace health promotion programs (WHPP) are a common strategy used to enhance on-the-job productivity and reduce the presenteeism effect. Preliminary evidence indicates that some WHPP's have had positive influence on decreasing the impact of presenteeism on organizations (Cancelliere et al., 2011).

Barriers to the wellness program's influence include lack of participation and diminished initial behaviour over time (Shannon, et al., 2001; Morrison &

Mackinnon, 2008). Lack of participation in control groups was shown in Chevron to be the cause of no beneficial effect as participants experienced lower inpatient and drug expenditures (Goetzel et al., 1998). Strategies to improve participation in wellness fitness workplace programs include: connecting behavioral interventions to organizational policy, creating visible employer support, promoting incentives for behavior, linking financial incentives to insurance premiums, developing program in a cooperative effort between management and employees and creating the image that the program is not an extra workload burden (Makrides, et al., 2011; Morrison & Mackinnon, 2008).

Section 2.2 Wellness Fitness Case Studies

Numerous studies and reviews have been conducted regarding wellness fitness programs' impacts on diverse organizations. In organizations that implemented wellness fitness programs, it was generally found, that they resulted in increased levels fitness and a reduction in the risk factors for coronary heart disease (Gebhardt & Crump, 1990). These industries recognized the benefits in numerous ways such as reduced health-care expenditures and health-insurance premiums. Below is a review of literature that has investigated wellness fitness health programs implemented in various employment sectors.

Data collected in over a 100 peer-reviewed studies spanning 30 years was reviewed. In the various studies covered, estimates of organizational

medical costs decreased by approximately $3.27 and absenteeism costs by approximately $2.73 for every dollar invested in wellness programs (Baicker, Cutler, & Song, 2010).

A study conducted on 6,246 employees over a 6-year period in the Washoe County School District did not detect any significant health-care cost reductions but did detect reduced absenteeism as a benefit of investment in a wellness and fitness program. The decrease in absenteeism was estimated to translate into $15.60 US of cost savings for every dollar spent on the program. It was observed that a potential reason for a lack of significant health-care cost reductions may have been due to the short time period (Aldana et al., 2005).

In a large agribusiness organzation with a study population of 3,737 a study was conducted to observe the impact of a workness wellness program on the personnel. The program had 80% participation that was likely supported by a financial incentive for those who adopted and maintained healthy lifestyles. The results of this study indicated that the particpants with low baseline health at the beginning of the program experienced the greatest benefit at the end of the program, but in general, all participants had higher levels of health (Merrill et al., 2011).

Research investigating a wellness workplace program consisting of 472 employed participants from 2009-2010 found that employees experienced decreased job satisfaction but increased health and life satisfaction. The wellness program in this study was implemented by an outside contracted

company. It was noted that one possible reason for decreased job satisfaction may have been the poor US economy of 2009, which caused reduced job security. The number of participants in the study with borderline high blood pressure decreased, but no change in body-mass index (BMI) was noted (Merrill et al., 2011).

A meta-analysis conducted on organizational wellness programs containing 10,185 individuals from various organizations with wellness initiatives implemented into their organizations showed evidence of reduced absenteeism and increased job satisfaction (Parks & Steelman, 2008). The findings generally supported the assumption that employees who participate in wellness programs are healthier and less likely to experience sickness-related absenteeism. These findings were similar to further studies in the literature review.

A study surveying 683 workers from various types of employment indicated that high levels of physical activity led to improved work quality. Increased levels of cardiovascular fitness correlated with increased quantity of work. This result was due to the reduction in effort required to perform the work or tasks (Pronk et al., 2004). The fitness gained by the employee was transformed into a benefit for the firm.

Johnson and Johnson is the most diversified and biggest health-care company in the world, employing 100,000 employees globally, 40,000 of whom are employed in the United States (Ozminkowski et al., 2002). Johnson and

Johnson have had a wellness program initiated since 1979 and have estimated cost savings of 250 million over a decade (Berry et al., 2010). Johnson and Johnson have recognized decreased absenteeism resulting from their implementation of a wellness fitness program (Jones et al., 1990). Further long-term research found on a 4-5-year follow up noted that the benefits of Johnson and Johnson's wellness program were still being experienced in the form of reduction in medical-care costs experienced yearly (Ozminkowski et al., 2002).

A large United States industrial-based study population consisting of hourly paid employees was analyzed for 2 years. This study found significant reductions in absenteeism. It tested 29,315 wellness-program participants, compared to a 14,573 non-participating participants who acted as a control group. The result was a net difference of 11,726 absentee days (Bertara, 1990). This research further supports the likelihood of reduced absenteeism being the result of a wellness initiative.

Section 2.3 Wellness Fitness Programs in Canada

The Canadian population is suffering from a high frequency of modifiable health issues such as physical inactivity, smoking, obesity, hypertension and dyslipidemia, all of which imposed significant economic and social burden (Tanuseputro et al., 2003). A Canadian Community Health Survey (CCHS) conducted in 2000 found that approximately 80% of the population

between the ages of 20 and 59 years had one or more of the aforementioned modifiable risks (Heart and Stroke Foundation of Canada 2003).

Canadian employers are moving towards wellness-orientated programs in the workplace to help dissolve some health-care costs. These workplace health-program initiatives emerged in Canadian culture starting in the 1970s and became more comprehensive over time; their implementation has continued to the present. Fitness-and-wellness-type promotions are the most common workplace health promotions, accounting for nearly 30% of all health-promotion programs in Canada. There is a limited amount of scholarly literature based on Canadian workplace wellness program initiatives. (Morrison & Mackinnon, 2008)

Canadian research involving wellness fitness impacts have been conducted with no significant connection between the industry sector and fitness-program implementation. Wellness programs were more likely to be found in certain areas of Canada than others; the Maritimes had the highest concentration, with 46% of worksites having wellness programs (Macdonald et al., 2006). Looking the national average, construction workers are more likely to report not missing any days of work, and those in government service are more likely to have missed six or more days (Cragg et al., 2008).

An article by Makrides et al. (2011) investigated the relationship between health risks, absenteeism and drug costs by completing an analysis of the workplace wellness program implemented by the Department of Justice (DOJ)

of the Nova Scotia Public Service, Canada. The population studied had a high rate of risk, with 30% of the population suffering from 3 or more modifiable health risks. This study found that using the workplace for fitness improvement was beneficial to both employee and employer alike. Results also suggested that healthier employees were more likely to be retained.

Section 2.4 Fire Department Justification and Case Studies

It is well recognized that the fire service is a career with inherent risk as it continues to be one of the most dangerous occupations in North America (International Association of Fire Fighters, 2008). Every year an estimated 10,000 injuries are documented. While the majority of injuries are minor, large percentages are debilitating career-altering injuries. Occupational injuries continue to be the leading cause of disability and early retirement among firefighters.

Firefighters have an increased likelihood of death or injury in the line of duty compared to most other occupations (International Association of Firefighters, 2000). The physical stress that firefighters face enhances the risk of musculoskeletal injuries and cardiac complications (Rhea et al., 2004). Cardiovascular disease is the leading cause of line-of-duty death among fire personnel, with nearly half of firefighter fatalities being cardiovascular events (Kales et al., 2007).

Cardiovascular risk in firefighters is increased when compared to other professions and is the number one cause of line-of-duty death (Kales et al., 2005). Cardiovascular deaths account for 45% of all line-of-duty firefighter deaths in the United States (Kales et al., 2007; Staley, 2009; International Association of Fire Fighters, 2008; Smith 2011). As a firefighter grows older and his or her time in the fire service increases, there can be the potential for an increase in inactivity, hypertension, low fitness levels and obesity (Rosenstock & Olsen, 2007). This decrease in overall fitness has the potential to add further stress to the firefighter's physiological system.

Firefighters have a high rate of injury when compared to other professions (Rosenstock & Olsen, 2007). Szubert & Sobala (2002) indicate that firefighters have rates of injury 7 times higher than the US national workforce. Firefighters can suffer from various types of musculoskeletal injuries caused by factors such as overexertion, the distorting body positions that are inevitable in the line of duty, and the heavy loads that are imposed on their spines by equipment and by the tasks they conduct (Kim, 2010). Overexertion is a significant cause of both cardiac incidences and musculoskeletal injuries and is the primary factor in the majority of muscle injuries (Fahy & Leblanc, 2001; Walton et al., 2003). Every year, multitudes of injuries resulting from work and training are recorded. While the majority of injuries are minor, there are alarming numbers of career-ending debilitating injuries (TriData Corporation, 2005). Recovery time from injuries is variable, but research indicates that

increased age leads to increased recovery time. Gender also influences frequency of injury (Liao et al., 2001).

Firefighting is not only a physically and psychologically demanding profession; it is also a hazardous one (International Association of Fire Fighters, 2008; Smith et al., 2010). At every emergency scene, firefighters undertake a variety of duties that include connecting hose lines to hydrants and operating equipment such as fire-truck pumps, high-pressure hoses, and position ladders. Firefighters commonly perform heavy lifting, practice rapid building alterations, rescue victims, provide emergency medical attention, ventilate smoke-filled areas, and attempt to salvage the contents of buildings, all while carrying the additional weight of their protective gear and self contained breathing apparatus (SCBA) (Elsner & Kolkhorst, 2008).

The tasks conducted by the fire department's personnel require physical fitness to cope with physically demanding work in environments that have any combination of high heat, low oxygen, high carbon monoxide, hazardous materials and other toxic combustible products (Haas et al., 2003). These tasks are often conducted both in these dangerous environments and under time constraints. The nature of the tasks conducted in such circumstances can have negative long-term side effects to firefighter health as well as potentially immediate short-term consequences, as these environments are typically not capable of supporting human life.

The physical demands of firefighting require high levels of muscular strength and endurance combined with high levels of anaerobic and aerobic capabilities (Pearson et al., 1995; Melius, 2001; Holmer & Gavhed, 2007; Smith 2011). Contrary to other professions, firefighting requires a person to work at near maximal heart rates for extended periods of time (Peate et al., 2002; Abel et al., 2011). Having adequate fitness assists a firefighter in coping with the physiological stress a body experiences during activities requiring high fitness output (Smith 2011).

Several factors can add to the physiological stress the firefighter's body undergoes when in the line of duty. Firefighters' exposure to these hazards and times of extreme physical output are episodic in nature (Rosenstock & Olsen, 2007). At an emergency scene, firefighters lack the benefit of a warm-up, rest or hydration, and they may be expected to be at maximal exertion almost immediately. These circumstances can place a considerable amount of strain on the cardiovascular system due to the high amounts of oxygenated blood required to support heavy muscular work; as well, the skin will be affected by the thermoregulatory demands of work in a hot environment (Pearson et al., 1995). The potential for a super-heated environment on the fire-ground further compounds this issue, as do the time constraints under which firefighter are forced to work.

Protective gear, which protects a firefighter from the external environment, inadvertently causes restrictions to movement, adds bulk and

weight (often in excess of 22 kg), and increases body temperature due to its insulating properties. These factors further contribute to the physiological stress a firefighter experiences while conducting fire suppression activities. When hard work, protective clothing, and a lack of air movement are combined, a life-threatening core-temperature increase may occur (Sharkey & Davis, 2008; Smith 2011).

Firefighters also have an increased risk of back injury (overexertion injury) compared to other professions. Back injuries account for approximately 50% of all line-of-duty injury retirements each year (International Association of Firefighters, 2000). Firefighters place great stress on the lower back when lifting and carrying heavy or awkward loads or performing arduous tasks. Back injuries represent a significant cost in time off and medical expenses (International Association of Firefighters, 2000). Studies show fitness can help prevent back injuries (Cady et al., 1979).

An inadequate fitness level has the potential to increase the risk of injury and reduce performance (Abel et al., 2011). A high level of fitness has been shown to reduce the number of injuries in the workplace (Smith 2011). Fitness levels are a vital part of the job, as they can influence safety not only for firefighters but for their coworkers and rescue patients. Fit and healthy fire personnel with adequate levels of aerobic fitness have improved ability to perform the required tasks and reduce the risks of cardiopulmonary conditions (Peate et al., 2002). Furthermore, firefighters with high aerobic capacity can

perform tasks at a lower relative intensity and with less fatigue and decrease their risk of cardiovascular disease and sudden death (Elsner & Kolkhorst, 2008). Cardiovascular disease is a chronic injury among firefighter (Kales et al., 2003; Kales et al., 2007), and mitigating its impact is of paramount importance. This demonstrates the importance of maintaining fit personnel, as it is a requirement of the job. Physical fitness can be improved through the implementation of a comprehensive fitness program (Abel et al., 2011).

Wellness and fitness programs have been gaining popularity in fire departments and other industries. Fitness promotion, medical screening and improved medical management could prevent many of the premature line-of-duty deaths in the firefighting industry and should be promoted and provided by fire management (Kales et al., 2003). Numerous studies have shown the benefits of fitness programs in both firefighters (Cady et al., 1985; MacKinnon, et al., 2010) and industries outside the fire service, where fitness is not directly related to the job (Gebhardt & Crump 1990; Kellett et al., 1991). On the opposing side, there have been also been some examples where negative impacts have occurred incidentally from the use of a wellness-type promotion.

A study was conducted on Maryland US firefighters to analyze the effects of a wellness fitness program that was developed in accordance with NPPA standard 1582. Costs for an average work-related injury were estimated to be $13,420, with an average time loss of 8.8 days. The study demonstrated that after implementation of the wellness fitness program, the injury rate of the 242

participants decreased 40% the first year and 60 percent the second. Additionally, originally obese participants showed evidence of weight loss, which could have contributed to a reduction in cardiovascular disease, throughout the program. The study concluded that wellness fitness programs could lead to significant cost savings for fire departments (Leffer & Grizzell, 2010).

A Polish study investigating firefighter injuries using a random sample of 1,503 fire fighters over a 4-year period noted that dislocations and distortions were the injuries most frequently responsible for accident-related absenteeism (Szubert & Sobala 2000). These incidences can contribute to a significant human and financial toll to personnel and the cities where they work through lost work hours, higher insurance premiums, overtime, disability, and early retirement payments (TriData Corporation, 2005). Szubert & Sobala (2002) estimated that Polish firefighters left the job because of early retirement or permanent disability at a rate 60% higher than the national average (Szubert & Sobala, 2002).

A study conducted on 599 fire fighters from 5 separate fire departments in the United States assessed the implications of 2 separately applied health programs. One promotion was a peer-taught initiative, and the other program was an individually applied health promotion. Both programs had positive influence on the firefighters' health by reducing body mass index. Over a 3-year

period, the positive health effects were still observable, as long-term behaviors had been changed (MacKinnon, et al., 2010).

Research conducted from 1970 to 1983 using 1,800 firefighters found that after a wellness-type program had been initiated, firefighters' work capacity had increased an average of 16% by 1982. Older members in a sub-population recognized even greater benefits than the overall average. An additional benefit was reduced habitual smoking (Cady et al., 1985).

Studies conducted on Swedish firefighters showed that injuries from fitness activities were common; however, the majority (82%) of these firefighter injuries happened during competitive forms of high-impact fitness such as soccer and floor-ball. The commonly injured body parts were knee and ankle joints with meniscal or sprain damage. This outlines the need for proper fitness training programs with physical activities that promote fitness without causing injury (Bylunda & Bj¨ornstigb, 1999).

Fitness is a critical asset for a fire fighter. There is a relationship between firefighter fitness and job performance (Williford et al., 1999). High fitness levels aid fire fighters in conducting the strenuous, sometime dangerous activities they encounter doing occupational tasks. Without a high level of fitness, they cannot do their job as safely or effectively. Firefighter performance and safety is directly related to fitness. Fitness programs have the potential to enhance overall health, improve performance, and lessen the risk of injury, cardiac incidents and fatality (Smith 2011).

The wellness program makes economic sense as it has the potential to reduce injury Compensation claims and cost while simultaneously improving fire fighter health and longevity. To add to this there is significant research supporting reduced absenteeism. The fire service and the public have the potential to reap the benefits of a Wellness Fitness program. The hypothesis for this project based on the literature reviewed is that the Prince George Fire Department Wellness Fitness Project will have a positive effect on the reduced absenteeism.

Chapter III

Database and Methodology

This chapter presents an overview of the database and methodology used in the study. This chapter is organized into two sections: (a) Data base and (b) Methodology.

3.1: Database

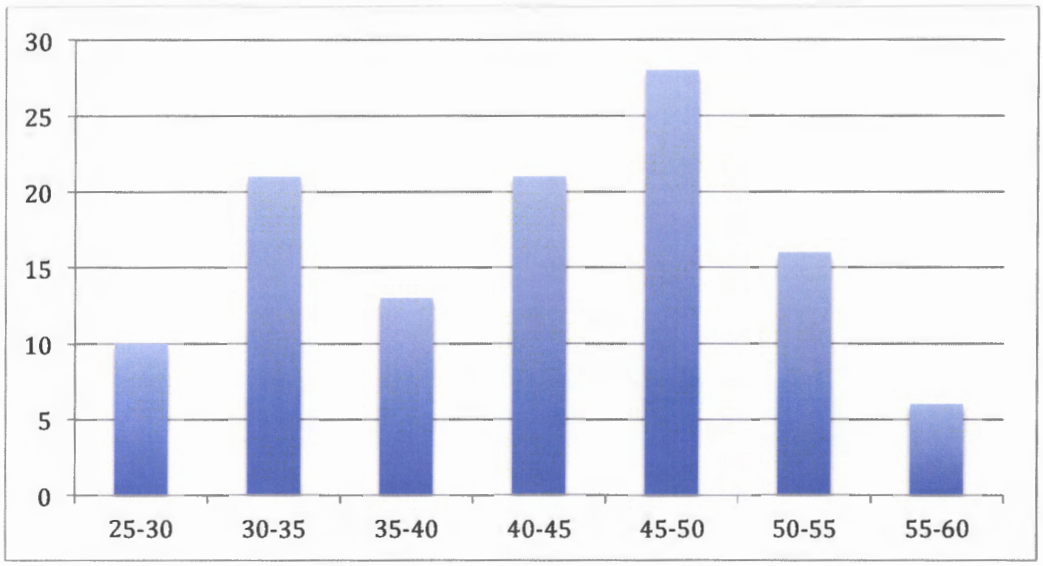
As mentioned in Chapter 1, the main purpose of this study is to examine whether intervention strategies involving providing health and wellness infrastructures to first responders (firefighters) could result in positive outcomes such as reduced injuries and lower absenteeism among the staff. This change would have major efficiency and financial implications for the conduct and performance of the Fire Department.

The study is based on the experience of firefighters in the City of Prince George British Columbia, Canada. It may be mentioned that Prince George is the premier city of northern British Columbia and has 105 full-time firefighters. The main source of data is the administrative records of fire-department employees exposed to the Wellness Fitness Initiative. Data relating to sick hours and related data (age and experience) were collected for 115 active firefighters from the administrative records and hence reflect a population picture of the city. All firefighting employees are unionized, career firefighters and their behavior and outcome could be a good indicator of similar experiences elsewhere. The

data collected from administrative records were stripped of all personnel identifiers in order to avoid personal identification. All the employees participated in the program and therefore there is no "survival bias" in the data.

The firefighters have an average age of 42.35 years. The age distribution of firefighters in Prince George is shown below in Figure 3.1.

Figure 3.1: Age Class Distribution of Prince George City Firefighters



Data for the past 8 years (for 115 firefighters) were collected and analyzed to examine the effectiveness of the wellness fitness program on factors such as injuries and work absenteeism. The data collected relate to "common sick days"- time available from a collective pool after all an employee's sick time is used up. It is defined in the Prince George Collective agreement (2007) as follows "Each employee is entitled to a maximum of 92 working shifts or 26 calendar weeks whichever is greater". WCB hours are hours accumulated after a

work incident in which, an employee is injured and consequently unable to fulfill the work requirements. In the fire profession, this can be common occurrence, but injury type and time vary immensely.

Table 3.1 Absentee Variables and Definitions[1]

Absentee Variable	Definition
Sick Hours	Time accumulated by the PGFD for use of absenteeism due to illness or injuries incurred off duty.
Common Sick Hours	Time accumulated from a collective pool of hours contributed to monthly by all firefighters. This is used after all an employee's sick time is used up.
WCB Hours	Hours accumulated from injuries while on duty.

All data collected were aggregated to conduct analysis. The study adopts a "before (5 years) and after (3 years)" model to gauge the effectiveness of the Wellness Fitness program on the Prince George Fire Department. The indicators used were sick days, common sick days and WCB hours. Sick days are days used to reflect absenteeism from work. They are defined in the Collective agreement between the City of Prince George and IAFF Local 1372 (2007) as "the period of time an employee is permitted to be absent from work with full pay by virtue of being sick or disabled or because of an accident for which compensation is not payable under Workers Compensation Act."

[1] Raw data on these variables is provided in Appendix 4

3.2: Methodology

In order to understand the differences in sick hours before and after the introduction of the program standard "t"-tests were used to investigate if there was any difference in average sick hours in these periods. The null hypothesis is that there are no differences in average sick hours before and after the Wellness Fitness program (i.e., $\mu_1 = \mu_2$ where μ_1 and μ_2 refers to sick hours before and after the introduction of the Workplace Wellness program).

The "t" tests were supplemented by regression analysis the using the ordinary least square (OLS) method. In order to estimate the of trend of decline/advance in average sick hours, the following equations were estimated:

Log-Linear

$$Log(Y) = \beta_0 + \beta_1 T + \varepsilon_{it} \qquad (1)$$

Where Y is the log of sick hours of all employees, "T" is the time. Equation (1) provides an estimate of trend growth rate.

Parcel Regression Technique

In addition, a panel regression estimation of the following form was also conducted

$$(Y) = \beta_0 + \beta_{1Age} + \beta_{2EXP} + \beta_{3Dummy} + \varepsilon_{it} \qquad (2)$$

Where Age = Age of the employee (years), EXP= Experience of the employee (years), and Dummy = 1 for years post WWP introduction since 2009 and 0 otherwise.

Chapter IV

Empirical Results

This chapter presents the results of the empirical analysis based on the methodology outlined in chapter 3. This chapter is organized into three sections: the first section presents the results of trend analysis during 2005-2011. Section 2 records trends in sick hours before (2005-08) and after (2009-11) the introduction of the Workplace Wellness Program to the Prince George Fire Department. Section 3 summarizes the conclusions.

Table 4.1: Trends in Sick Hours among Firefighters in Prince George: 2005-2011.

Period	Variables		
	Sick hours (Average)	Common Sick hours (Average)	WCB Hours (Average)
Pre WFI 2005-2008	12,079.43	1,255.38	1,492.75
Post WFI 2009-2011	7,265.00 (0.04)	641.00 (0.13)	910.60 (0.25)
Whole Period 2005-2011	10,016.10	992.07	1,243.26

Note: figures in brackets are p-values based on" t"-test.

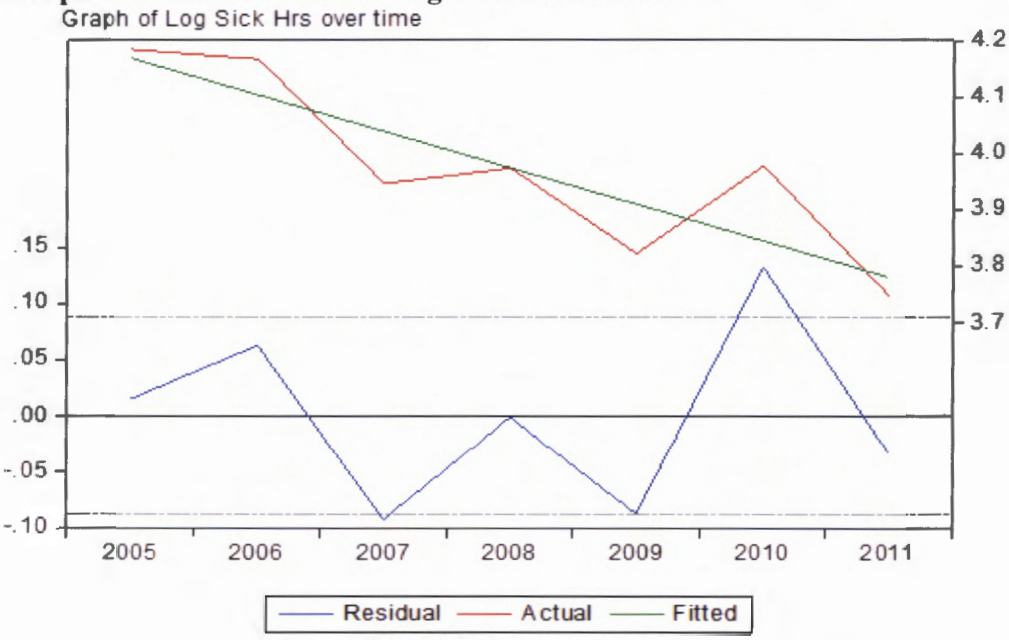
Table 4.1 presents trends in sick hours of firefighters in Prince George during 2005 to 2011. The number of sick hours is a good proxy for the health and wellness of firefighters: the lower the sick hours the better the health and wellness of firefighters. During 2005-11, the number of sick hours has shown a

declining trend. In order to understand the slope of the negative trend, a fitted a semi-log equation of the following form was used.

$$Log(Y) = \beta_0 + \beta_1 T + \varepsilon_{it} \qquad (4.1)$$

Where Y is the log of sick hours of all employees, "T" is the time. Equation (1) provides an estimate of the trend growth rate. The results of the regression are reported in Table 4.2. As is evident from the coefficient associated with the slope coefficient (T), the number of sick hours has declined by 6.4 per cent during 2005-11. This is further outlined below in Graph 4.1.

Graph 4.1: Results of Linear Regression of Sick Hours



Graph 4.1 shows the logarithm of sick hours vs. time on the bottom. A noticeable decline is present. The x intercept has slope a of -0.064 indicating a decrease over the time period.

Table 4.2: Empirical Results of the Trend Equation (Equation 4.2) of Sick Hours.

	Dependent Variable		
	Log (Sick Hours)	**Log (Common Sick Hours)**	**Log (WCB Hours)**
Variables			
Constant	4.23	2.93	2331.74
	(56.54)***	(9.56)***	(2.99)***
T	-0.06	-0.01	-272.12
	(-3.86)**	(-0.11)*	(0.18)*
Diagnostics			
R Bar Square	0.75	-0.20	0.19
F-statistics (p-value in brackets)	14.90 (-0.01)	0.02 (-0.92)	2.45 (-0.18)
Standard Error	0.02	0.12	0.74
Akaike Info Criterion	-1.77	1.04	16.72
Schwarz Criterion	-1.79	1.03	16.71

Notes: Figures in brackets are 't' values; ***, **, * indicates statistical significance at 1%, 5% and 10% respectively.

Table 4.2 demonstrates the different averages between the two populations as well as p-values from "t"-tests. All three indicators show smaller averages. The pre and post-WWP populations were tested using a "t"-test to investigate if the average sick hours were significantly different. The "t"-test allowed us to answer this question by determining a p-value that indicated how likely it was that results could be obtained by chance. By convention, if there is less than a 5% chance of getting the observed differences by chance, we reject the null hypothesis and accept the hypothesis and say we found a statistically significant difference between the two groups. As shown in Table 4.2, both categories of absenteeism showed significant reductions between pre- and post-

WWP.

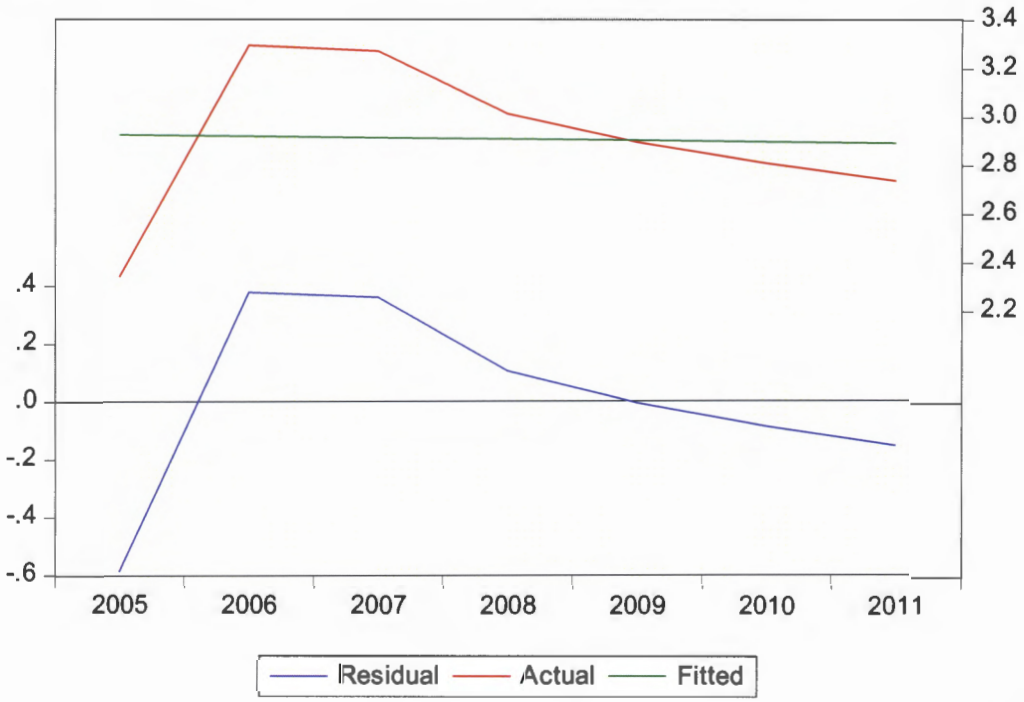
Table 4.3: Panel Regression Results of Sick hours (Equation 4.3)

Dependent Variable: Sick Hours		
Independent Variables	**Linear**	**Semi-log**
Variables		
Constant	152.12 (33.60)***	5.02 (161.704)***
Experience	0.30 (-1.49)	0.002 (1.54)
Age	-0.24 (-1.58)	-0.0016 (-1.60)
Dummy	-92.74 (-9.15)***	-0.99 (-14.18)***
Diagnostics		
R-Squared	0.47	0.68
F-statistics (p-value in brackets)	29.73 (0.00)	70.97 (0.00)
Akaike Info Criterion	7.43	-2.53
Schwarz Criterion	7.53	-2.43

Notes: Figures in brackets are 't' values; ***, **, * indicates statistical significance at 1%, 5% and 10% respectively.

Table 4.3 above reports the results of panel regression for the period 2005-2011 (linear & semi-log). The panel regression results show that the dummy variable is negative and statistically significant indicating that sick hours in the post WWP period has underwent substantial reductions. This further supports the argument that when controlling for age and experience sick hours are statistically reduced in the post-WWP period.

Graph 4.2: Linear Regression of Log of Common Sick Time Over Time



Common sick time is a pool of time contributed by all fire personnel to accommodate absentee time not covered by either WCB or sick hours. A reduction is noted between pre- and post-WWP groups.

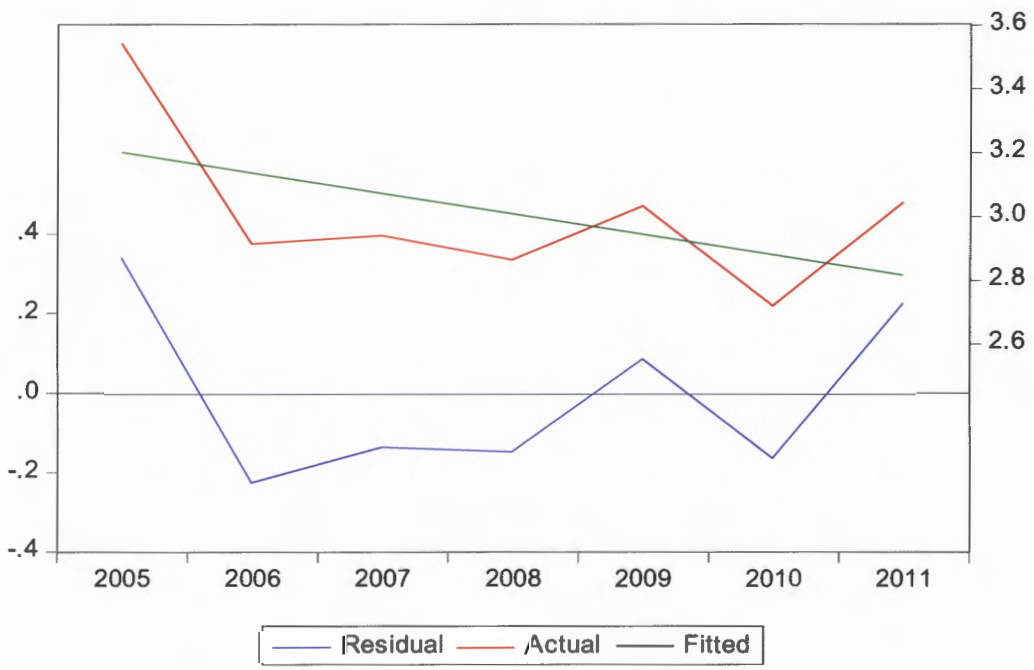
WCB Hours

WCB hour's represents the portion of absenteeism where employees have taken time off due to line of work injuries. Many injuries are non-time loss and do not cause incurred costs or time loss. There has been a reduced average in the post WFI group when compared to pre WFI group.

Injury and more specifically WCB hours cannot fairly represent the actual impact of the workplace wellness program as they are influenced by

erogenous variables. There are several reasons for this variable to unfairly represent the program impact. Certain injuries are non-preventable even with excellent participant fitness. For instance some emergency tasks or scenarios can inadvertently cause injuries. This can decrease the ability of WCB hours to truly reflect health or fitness adequately. Although there has been a major reduction in WCB hours this is likely a result of a reduction in major injury incurring incidents.

Graph 4.3: Linear regression analysis of Log of WCB Hours Over Time



As shown in graph 4.3 there is a reduction in WCB hours over the time period. A peak occurs in 2009, which corresponds to the 9 line-of-duty lost time incidents shown below in Appendix 3.

Chapter V

Conclusions

The empirical investigation into the efficiency of the WWP in the Prince George Fire Department for the period 2005 – 2011 based on the data from (a) sick hours and (b) common sick hours before (2005-2008) and after (2009-2011) yielded interesting results. The study found a statistical reduction in both sick and common sick hours for the Prince George firefighters after the implementation of the WWP. These results are statistically different and robust.

The results of this investigation support the hypothesis. The Prince George Fire Department Wellness Fitness Project had a positive effect on the reduced absenteeism. This is likely due to a healthier department having increased fitness and better capabilities of dealing with the associated stress of firefighting activities and daily health issues. The results indicated in Graphs 4.1 and 4.2 show a downward trend in absenteeism with time. The results of the empirical investigation (both trend analysis and panel regression), clearly shows that has been a substantial decline in sick hours in the post- WWP in Prince George Fire Department.

WCB hours did not show a reliable trend. The improved fitness found in the department likely did not influence the work injuries due to the extraneous nature of the injuries and injury incidence. Fire-department work does not allow complete mitigation of injuries through improved fitness; however, though there

is likely a reduction, quantifying it is difficult due to variability of injury frequency and severity. The injuries experienced are often are impact, twist or heavy lift in nature, where fitness can help to a certain extent but fails to protect the individual completely. The very character of the work is to risk personal health for others at times when the risk is deemed acceptable.

The WPP has various implications to the Prince George Fire Department. There is a financial element due to the reduction in sick days causing cost savings that could potentially offset both initial capital expenditures and continued operational requirements. A healthier work force also has the ability to lead to a more productive and efficient team. The increased fitness can also lead to a potential reduction in health-care expenditures. The WPP allows for a holistic approach where employees experience healthier physical, emotional and social benefits. Many benefits are difficult to quantify but are still recognized when a properly implemented WPP is used as a corporate strategy.

This information can be used to support this department's effort, as well as the efforts of other public sectors, in choosing to implement a Workplace Wellness Program initiative as a method of experiencing cost savings and creating a healthy work force. As discussed in the literature review, the private sector has been implementing WWPs for some time with considerable success.

This study has certain limitations. The primary limitation of this study is the short time period from which to study the impacts of the WWP. Over a longer time frame the "t"-test could have greater reliability and the impacts of

the WWP may be more noticeable and reliable. As it is early in the WWP, all employees may not have fully recognized the benefits of fitness in their lifestyles. Another weakness of this study is that employees who take one sick day may be inclined to take a second sick day because there is limited incentive to return earlier. Any time greater than 2 days for being sick requires a letter from a doctor. This has the potential to skew the impact the WWP is actually having on the department. The last limitation, although minor, is caused by the ability of a member to use sick time for incidents of Family Illness. Family Illness is described by the Collective agreement between the City of Prince George and IAFF Local 1372 (2007) as "in the case of illness of the employee's spouse or child, when no one at home other than the employee can provide for the needs of the ill person, the employee shall be entitled up to three consecutive shifts of accumulated sick leave at any one time for this purpose." Although this likely represents a minor amount of sick time it does have the potential to slightly increase the amount of sick time and reduce the ability of the research to accurately ascertain the exact impact of the WWP and sick days.

This program is in the early stages of its implementation, and in order that one might properly assess and comprehend the impacts of the Wellness Fitness program on the Prince George Fire Department, one would need to initiate an analysis spread over a greater period of time would provide increased insight. A longer period of time would lend itself to allowing for the impacts to be more prominent and observable. The groundwork has been established and

future investigations could easily be conducted at a later date and added to the data already collected.

A survey completed by employees on their use of the program as well as a comparison of their individual health progress would break the impacts down more completely and allow for a more in-depth look at the impacts on individual employees.

References

Abel, M. G., Mortara, A. J., & Pettitt, R. W. (2011). Evaluation of circuit-training intensity for firefighters. *The Journal of Strength and Conditioning Research, 25* (10), 2895-2901.

Abel, M. G., Sell, K., & Dennison, K. (2011). Design and implementation of fitness programs for firefighters. *Strength and Conditioning Journal, 33* (4), 31-42.

Aldana, S. G., Merrill, R. M., Price, K., Hardy, A., & Hager, R. (2005). Financial impact of a comprehensive multisite workplace health promotion program. *Preventive Medicine, 40*, 131-137.

Baicker, K., Cutler, D., & Song, Z. (2010). Workplace wellness programs can generate savings. *Health Affairs, 29* (2), 1-8.

BC Stats. (2011). *Community Facts.* Retrieved from http://www.bcstats.gov.bc.ca/data/dd/facsheet/cf163.pdf

Berry, L. L., Mirabito, A. M., & Baun, W. B. (2010). What's the hard return on employee wellness programs? *Harvard Business Review*, 88, 104 -112. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=55461938&site=bsi-live

Bertara, R. L. (1990). The effects of workplace health promotion on absenteeism and employment costs in a large industrial population. *American Journal of Public Health, 80*, 1101-1105.

Bylund, P., & Bjornstig, U. (1999). Medical impairing injuries among Swedish firefighters. *Work: A Journal of Prevention, Assessment and Rehabilitation, 12* (2), 117-122.

Cady, L. D., Bischoff, D. P., O'Connell, E. R., Thomas, P. C., & Allan, J. H. (1979). Strength and fitness and subsequent back injuries in firefighters. *Journal of Occupational Medicine, 21* (4), 269-272.

Cady, L. D., Thomas, P. C., & Karwasky, R. J. (1985). Program for increasing health and physical fitness of fire fighters. *Journal of Occupational Medicine*, *27* (2), 110-114.

Campo, M., & Darragh, A. R. (2012). Work-related musculoskeletal disorders are associated with impaired presenteeism in Allied Health Care Professionals. *Journal of Occupational Environental Medicine, 45* (1), 64-70.

Cancelliere, C., Cassidy, D. J., & Côté, P. (2011). Are workplace health promotion programs effective at improving presenteeism in workers? A systematic review and best evidence synthesis of the literature. *BioMedicalCentral Public Health , 11* (4), 395-405.

Cragg, S., Wolfe, R., Griffiths, J. M., & Cameron, C. (2008). *Physical activity among Canadian workers : Trends 2001 - 2006.* Ottawa: Canadian Fitness and Lifestyle Research Institute.

Dehejia, R. (2005). Program evaluation as a decision problem. *Journal of Econometrics, 125*, 141-173.

DiNubile, N. A., & Sherman, C. (1999). Exercise and the bottom line: Promoting physical and fiscal fitness in the work place: A commentary. *Physician & Sports Medicine, 27* (2), 37-43.

Elsner, K. L., & Kolkhorst, F. W. (2008). Metabolic demands of simulated firefighting tasks. *Journal of Strength and Conditioning, 51* (9), 1418-1425.

Fahy, R. F. (2005). *U.S. Firefighter Fatalities Due to Sudden Cardiac Death, 1995 - 2004.* Quincy, MA: NFPA, Fire Analysis and Research.

Fahy, R., & Leblanc, P. R. (2001). US firefighter fatalities. *NFPA Journal, 69*, 67-79.

Firpo, S. (2003). Efficient semiparametric estimation of quintile treatment effects. *Econmetrica, 75* (1), 259-276.

Gebhardt, D. L., & Crump, C. E. (1990). Employee fitness and wellness programs in the workplace. *American Phycologist, 45* (2), 262-278.

Goetzel, R. Z., Dunn, R. L., Ozminkowski, R. J., Satin, K., Whitehead, D., & Cahill, K. (1998). Differences between descriptive and multivariate estimates of the impact of Chevrons corporation's health program on medical expenditures. *Journal of Occupational & Environmental Medicine, 40* (6), 538-545.

Haas, N. S., Gochfeld, M., Robson, M. G., & Wartenberg, D. (2003). Latent health effects in firefighters. *International Journal of Occupational Health, 9*, 95-103.

Heaney, C. A., & Goetzel, R. Z. (1998). A review of health-related outcomes of multi-component worksite health promotion programs. *American Journal of Health Promotion, 11*, 290-308.

Heart and Stroke Foundation of Canada, Canadian Cardiovascular Society, Health Canada. *Growing burden of heart disease and stroke in Canada 2003. Ottawa, Canada: Heart and Stroke Foundation of Canada; 2003.*

Holmer, I., & Gavhed, D. (2007). Classification of metabolic and respiratory demands in fire fighting activity with extreme workloads. *Ergonomics, 38*, 45-52.

International Association of Firefighters. (2000). *Line of Duty Death and Injury Survey.* Ottawa: International Association of Firefighters.

International Association of FireFighters. (2008). *The Fire Service Joint Labor Management Wellness-Fitness Initiative 3rd Edition.* Washington, DC.

Imbens, G. (2004). Nonparametric estimation of average treatment effects under erogeneity. *A Review of Economic and Statistics, 86* (1), 1-29.

Imbens, G., & Woolridge, J. (2009). Recent developments in the econometrics of Program Evaluation. *Journal of Economic Literature, 47* (1), 586.

Jones, R. C., Bly, J. L., & Richardson, J. E. (1990). A study of a work site health promotion program and absenteeism. *Journal of Occupational Medicine, 32* (2), 95-99.

Kales, S. N., Soteriades, E. S., Christiani, D. C., & Christoudias, S. G. (2003). Firefighters and on-duty deaths from coronary heart disease: A case control study. *Environmental Health: A Global Access Science Source, 2*, 1-13.

Kales , S. N., Soteriades, E. S., Christophi, C. A., & Christiani, D. C. (2007). Emergency duties and deaths from heart disease among firefighters in the United States. *The New England Journal of Medicine, 356* (12), 1207-1215.

Kellett, K. M., Kellett , D. A., & Nordholm, L. A. (1991). Effects of an exercise program on sick leave due to back pain. *Physical Therapy, 71* (4), 283-291.

Kim, K. S. (2010, Nov). Health hazards in firefighters. *Hanyang Medical Review*, 30 (4), 296-304.

Lalonde, R. J. (1986). Evaluating the econometric evaluations of training programs with experimental data. *American Economic Review, 76*, 604-620.

Leffer, M., & Grizzell, T. (2010). Implementation of a physician-organized wellness regime (POWR) enforcing the 2007 NFPA standard 1582: Injury rate reduction and associated cost savings. *Journal of Occupational Environmental Medicine, 52* (3), 336-339.

Liao, H., Arvey, R. D., Butler, R. J., & Nutting, S. N. (2001). Correlates of work injury frequency and duration among firefighters. *Journal of Occupational Health Psychology, 6* (3), 229-242.

Loeppke, R., Taitel, M., Richling, D., Kessler , R. C., Konicki, D., & Hymel, P. (2007). Health and productivity as a business strategy. *Journal of Occupational Environmental Medicine, 49* (7), 712-721.

National Fire Protection Association. (2000). *Standard on health-related fitness programs for fire fighters.* National Fire Protection Association.

Macdonald, S., Csiernik, R., Durand , P., & Rylett, M. (2006). Prevalence and factors related to Canadian workplace health programs. *Canadian Journal of Public Health, 97*, 121-125.

MacKinnon, D. P., Elliot, D. L., Thoemmes, F., Kuehl, K. S., Moe, E. L., Goldberg, L., et al. (2010). Long-term effects of a worksite health promotion program for firefighters. *American Journal of Health Behavior, 34* (6), 695-706.

Makrides, L., Smith, S., Allt , J., Farquharson, J., Szpilfogel , C., Curwin, S., et al. (2011). The Healthy LifeWorks Project: A pilot study of the economic analysis of a comprehensive workplace wellness program in a Canadian government department. *Journal of Occupational Environmental Medicine, 53* (7), 799-805.

Manski, C. (1990). Nonparametric bounds of treatment effects. *American Economic Review Papers and Proceedings, 80*, 319-323.

Manski, C. (2004). Statistical treatment rules for heterogeneous populations. *Econometrica, 72* (4), 1221-1246.

Mattke, S., Balakrrishnan, A., Bergamo, G., & Newberry, S. J. (2007). A review of methods to measure health related productivity loss. *The American Journal of Managed Care, 13* (4), 211-217.

Melius, J. (2001). Occupational health for firefighters. *Occupational Medicine, 16*, 101-108.

Merrill , R. M., Anderson, A., & Thygerson, S. M. (2011). Effectiveness of a worksite wellness program on health behaviors and personal health. *Journal of Environmental Medicine, 53* (9), 1008-1012.

Merrill, R. M., Aldana, S. G., Garrett, J., & Ross, C. (2011). Effectiveness of a workplace wellness program for maintaining health and promoting healthy behaviors. *Journal of Occupational Medicine, 53* (7), 782-787.

Mitchell, R. J., & Bates, P. (2011) Measuring health-related productivity loss. *Population Health Management, 14* (2): 93-98.

Morrison, E., & Mackinnon, N. J. (2008). Workplace wellness programs in Canada: An exploration of key issues. *Healthcare Managment Forum , 21* (1), 26-31.

Ozminkowski, R. J., Ling, D., Goetzel , R. Z., Bruno , J. A., Rutter , K. R., Isaac , F., et al. (2002). Long-term impact of Johnson & Johnson's Health & Wellness program on health care utilization and expenditures. *Journal of Occupational Environmental Medicine, 44* (1), 21-29.

Parks, K. M., & Steelman, L. A. (2008). Organizational wellness programs: A meta-

analysis. *Journal of Occupational Health Psychology, 13* (1), 58-68.

Pearson, J., Hayford, J., & Royer, W. (1995). *Comprehensive Wellness for Firefighters.* New York, NY: Van Nostrand Reinhold.

Peate, W., Lundergan, L., & Johnson, J. (2002). Fitness self-perception and VO2 max in firefighters. *Journal of Occupational and Environmental Medicine*, 546-550.

Pelletier KR. (1993). A review and analysis of the health and cost-effective outcome studies of comprehensive health promotion and disease prevention programs at the worksite: 1991-1993 update. *American Journal of Health Promotion,* 8, 50-62.

Pronk, N. P., Martison, B., Kessler, R. C., Arne, B. L., Simon, G. E., & Wang, P. (2004). The association between work performance and cardiorespiratory fitness, and obesity. *Journal of Occupational Environmental Medicine, 46* (1), 19-25.

Proper, K. I., Staal, B. J., Hildebrandt, V. H., van der Beek, A. J., & Mechelen, W. v. (2002). Effectiveness of physical activity programs at worksites with respect to work-related outcomes. *Scandinavian Journal of Work Environmental Health, 28* (2), 75-84.

Rhea, M. R., Alvar, B. A., & Gray, R. (2004). Physical fitness and job performance of firefighters. *Journal of Strength and Conditioning Research, 18* (2), 348-352.

Rosenstock, L., & Olsen, J. M. (2007, March). Firefighting and death from cardiovascular causes. *The New England Journal of Medicine*, 356-312.

Shannon, H. S., Robson, L. S., & Sale, J. E. (2001). Creating safer and healthier workplaces: Role of organizational factors and job characteristics. *American Journal of Industrial Medicine, 40*, 319-334.

Sharkey, B. J., & Davis, P. O. (2008). *Hard work defining physical work performance requirements.* United States of America: Library of Congress Cataloging-in-Publication Data.

Simons-Morton, D. G., Calfas, K. J., Oldenburg, B., & Burton, N. W. (1998). Effects of intervention in health care Settings on physical activity or cardiovascular fitness. *American Journal of Preventive Medicine, 15* (4), 413-429.

Smith, D. L. (2011). Firefighter fitness; Improving performance and preventing injuries and fatalities. *Current Sports Medicine Reports, 10* (3), 167-172.

Smith, D. L., Manning, T. S., & Petruzzello, S. J. (2010). Effect of strenuous live-fire drills on cardiovascular and psychological responses of recruit firefighters. *Ergonomics, 44* (3), 244-254.

Smith, K. J., Everly, G. S., & Haight, T. G. (1990). An empirical analysis of the impact of corporate health promotion intervention on reported sick leave absenteeism. *Benifets Quarterly, 6* (1), 37-45.

Staley, J. A. (2009). Get firefighters moving: Marketing a physical fitness intervention to reduce sudden cardiac death risk in full-time firefighters. *Social Marketing Quaterly, 15* (3), 85-89.

Statistics Canada. (2007). *2006 Community Profile Prince George.* Retrieved from http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=English

Szubert, N., & Sobala, W. (2002). Health reason for firefighters to leave their job. *Medycyna Pracy, 53* (4), 291-298.

Tanuseputro, P., Manuel, D. G., Leung, M., Nguyen, K., & Johansen, H. (2003). Risk factors for cardiovascular disease in Canada. *Canadian Journal of Cardiology , 19* (11), 1249-1259.

TriData Corporation. (2005). *The economic consequences of firefighter injuries and their prevention.* National Institute of Standards and Technology. Department of Commerce.

Walton, S. M., Conrad, K. M., Furner, S. E., & Samo, D. G. (2003). Cause, type and workers compensation costs of firefighter injuries. *American Journal of Industrial Medicine, 2003*, 454-458.

Watson, W., & Gauthier, J. (2003). The viability of organizational wellness programs: An examination of promotional results. *Journal of Applied Social Phychology, 33* (6), 1297-1312.

Williford, H. N., Duey, W. J., Olson, M. S., Howard, R., & Wang, N. (1999). Relationship between fire fighting suppression tasks and physical fitness. *Ergonomics, 42* (9), 1179-1186.

Appendix

The Prince George Wellness Fitness Initiative

The Prince George Fire Department Wellness Fitness Initiative followed the template prepared nationally for firefighters. NFPA standards were put into place to improve safety for fire hazards and people. According to NFPA 1500, fire departments shall provide physical fitness programs that enable members to develop and maintain fitness to safely perform their assigned functions. NFPA 1583 specifically deals with mitigating health effects on fire personnel (National Fire Protection Association, 2000). The intent of the wellness program is to improve firefighter health by reducing premature firefighter musculoskeletal injuries and cardiovascular disease through health screening (International Association of Fire Fighters, 2008).

This high number of job-related deaths has led organizations such as the National Fire Protection Agency, International Association of Firefighters, and International Association of Fire Chiefs to consider and suggest physical training recommendations for fitness among firefighters (Rhea, et al., 2004). The Wellness Fitness program was developed in 1997 by a labour-management subcommittee. This was a combined effort between the International Association of Firefighters and the International Association of Fire Chiefs (IAFF/IAFC), which together became the Joint Labour Management Wellness/Fitness Initiative (WFI).

Components of the Wellness Fitness Initiative

The Wellness Fitness Initiative outlined in NFPA 1583 by the International Association of Fire Fighters (2008) is composed of five detailed subject areas:

1) Medical

Consists of an annual exam, job-specific for uniformed personnel, including physical evaluation, body composition, laboratory tests, vision testing, hearing evaluation, spirometry, EKG, cancer screening immunizations and infectious disease screening, referrals and data collection.

2) Fitness

Includes medical clearance, on-duty time for exercise, equipment and facilities, exercise specialists and peer trainers, incorporation of fitness into the fire-service philosophy, fitness evaluations of aerobic capacity, flexibility, muscular strength and endurance, fitness self-assessments and exercise prescriptions.

3) Medical/fitness/injury rehabilitation

This establishes a need and priority for rehabilitation, develops the program criteria, provides for a fire department medical liaison, provides for physical-therapy services, clinical pathway rehabilitation (standardized approaches to treatment), provides alternative duty programs and establishes an injury prevention program.

4) Behavioral health

Includes professional and coordinated assistance, marketing of health services, cessation of tobacco use, employee or member assistance programs, substance abuse interventions, stress management, critical incident stress management, comprehensive counseling services and chaplain services for spiritual needs.

5) Data collection and reporting

This establishes a mechanism for participating fire departments to compile data, develops a data dictionary, transfer specifications and contribute to the International Wellness/Fitness Database (International Association of Fire Fighters, 2008).

To assist with the implementation of a WWP in the department, a firefighter per shift is appointed to the position of Peer Fitness Trainer. The selected firefighters then receive training under the Peer Fitness Trainer Certification Program developed by the IAFF/IAFC and they are ultimately tasked with implementing the various components of the WWP throughout the various halls and shifts. This program is conducted in conjunction with the support of medical professionals in the community, including a contracted occupational-health nurse and a physician. These medical professional are required to assess each firefighter annually relative to the requirements of the medical section of the NFPA WWP standard. This allows for an ongoing record

of various health factors and allows for the monitoring of health risk factors that could potentially harm firefighters.

An initial Capital expenditure was required at the onset of the program. Complete gyms with industrial-rated cardio and weight equipment were placed in each of the 4 halls; they cost approximately $25,000 each. This equipment was purchased new and reconditioned to get the best possible combination of value and quantity. Each day, participants are allotted ample time for fitness activities between the emergency tasks and daily scheduled workday duties

Appendix Table 1: Operational Expenditures of the PGFD Wellness Fitness Initiative

Year	Expense	Value
2005	Doctor's services	197.60
2006	Doctor's services	400.10
2007	Doctor's services	100.00
2008	Doctor's services	293.05
	Medical Mart Supplies	6,500.00
	Medical Direction	500.00
2009	Doctor's services	926.05
	AMH Med Office Support	400.00
	Lifelabs	235.13
	Nurse Service	8,170.00
	NHA Screening	8,352.07
	Dr. Reddy	8,870.88
	X-rays	420.00
2010	Doctor's services	1,473.15
	UNBC - Behavioral Int	7,000.00
	Nurse Service	9,824.05
	NHA Screening	7,410.66
	Dr. Reddy	15,000.00
2011	Doctor's services	2,582.51
	Medical Direction	11,885.92
	Lecture - cancer talk	500.00
	Nurse Service	
	NHA - Screening	3,760.00
	Dr. Reddy	12,710.00
	Total	108,041.17

Appendix 1 above shows the operational maintenance costs of the WWP. Chief Lane, at the Prince George Fire Department, provided the above costs. The onset of the WWP is shown in 2008, as this was the initial stage that involved costs such as; sunk costs; planning and implementation.

Appendix 2: 2005-2011 Absenteeism Hours

Year	Sick hours	Common Sick hours	WCB hours
2005	15,304.52	216.50	3,524.00
2006	14,723.38	1,954.00	830.00
2007	8,855.00	1,841.00	879.00
2008	9,434.81	1,010.00	738.00
2009	6,656.00	768.00	1,087.39
2010	9,528.00	627.00	529.00
2011	5,611.00	528.00	1,115.40

Appendix 2 shows data from city records showing the various aggregative absenteeism variables.

Appendix 3: Prince George Fire Rescue Incident Summery 2009-2011

Count of Incident #			
Row Labels	**First Aid**	**Lost Time**	**Medical**
Twist injury		1	
Accidently stepped off edge.			1
Fell backwards onto buttocks and back.		1	
Air horn went off damaged hearing.			1
Physical training period and felt pain to arm.		1	
Brain tumor - problems since 1999		1	
Clean up at auto accident, cut on sharp edge.		1	
Bumped head	1		
During training injured back.		1	
Burned by embers while knocking down fire.			1
Exposure to unknown gas during emergency.			2
Felt pain in knee while running on treadmill.			1
Felt pain while hose testing.	1		
Dehydrated and overheated.			1
Hit depression enroute to call and ff hit head.			1
Struck head on door jam.	1		
Getting out of truck, knee twisted.		1	
Injured during training.		1	
Grabbed rail while coming down stairs.		1	
Hit by plank while working structure fire.			1
Hose testing at Hall 1.	1		
Jumped off a fence during emergency.			1
Lifted positive pressure fan and had back pain.		1	
Lifting a patient on a clamshell through a house.	1		
Lifting heavy patient on stair chair down stairs.			1
Lifting patient down stairs during emergency.	1		
Lifting patient from chair onto cot.	1		
Lifting patient in clamshell above head height.		1	
Lifting patient.	1		
Lifting stretcher, turned corner and it twisted.			1
Pain to back while weight training at Hall 1.			1
Reached down and felt pain in back.			1
Injured back practicing rescue.		1	
Pull starting engine at Fire Hall 1.		1	
Reaching to place hydrant back, injured back.		1	
Repetitive Emergency Medical Responder practice.	1		
Responding to call, descending stairs, felt pain.			1
Contacted sharp metal edge.	1		
Slipped and fell down basement stairs.			1
Slipped and fell on ice while shoveling.	1		

Slipped on ice and fell to ground.		1	
Slipped on ice during emergency.	1		
Slipped on linoleum floor.			1
Slipped on snow and ice and fell to ground.		1	
Slipped returning medical kits.	1		
Stepped off fire truck at Hall 3 and twisted back.		1	
Stepped off fire truck onto uneven edge.		1	
Injured stepping down.		1	
Stepping down from truck and felt pain to back.		1	
Stepping off E11 slipped and fell to ground.	1		
Feet slid out from under worker.		1	
Nauseous and dizzy after call.			1
Tool came loose and fell on foot.			1
Tripped on debris during suppression operations.			1
Was startled and whipped head around.			1
Worker tripped and injuring his ribs on fire.		1	
Hit knee into edge of vehicle bumper.	1		
Woke up with pain.			1
Worker slipped on a roof, injuring his left shin.	1		
Working and had pain in chest.			1
Total	**16**	**22**	**23**