

# FIREFIGHTERS AND CANCER: UNDERSTANDING RISK FACTOR IN AN ENVIRONMENT OF CHANGE



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## Introduction

Numerous scientific studies have documented higher incidence and mortality rates of various forms of cancer among firefighters, with some studies examining causative forces and others emphasizing prevention strategies (Daniels, 2014; Daniels, 2015; Pukkala, 2014; Zeig-Owens, 2011; Ma, 2006; LeMasters, 2006). This growing body of literature has fuelled various policy discourses related to wellness programs, improved technology, enhanced education and training, and more contentious, presumptive cancer health insurance designations.

The magnitude of the 9/11 disaster raised the profile of these issues largely due to the number of firefighters impacted and the unprecedented media attention it garnered. Research studies examining cancer rates fuelled and were fuelled by a range of health and wellness initiatives that described firefighters as experiencing concerning levels of depression, sleep deprivation (Mehrdad, 2013), poor physical and mental well-being, and problematic alcohol consumption, nicotine abuse, and caffeine overuse (Carey, 2012).

This report has two primary objectives: first, to provide an overview of the literature regarding the incidence, prevalence, and mortality rates of cancer in the general population, then use these statistics as a baseline framework to understand the parallel but amplified cancer rates in firefighters; and second, in light of the risk, to explore some of the challenges and opportunities in relation to the mitigation of cancer risk within the fire service.

## Cancer in the General Canadian Population: Incidence, Prevalence and Mortality Trend Data

In order to understand the higher rates of cancer among firefighters, it is necessary to first examine the cancer statistics of the general population at large. According to the 2015 Canadian Cancer Statistics, the average person in Canada is at high risk for cancer. In fact, cancer has become the leading cause of death in Canadians, having surpassed heart disease in 2007. In 2015, there will be an estimated 196,900 people in Canada who will be diagnosed with cancer, and approximately 78,000 will ultimately die of this disease (Canadian Cancer Society, 2015).

These statistics portend that two out of five Canadians will develop cancer at some point during their lifetime, and one in four will eventually die of cancer or its complications. Slightly more men than women are effected, in a ratio of 52% to 48%. The average Canadian male has a 45% lifetime probability of developing cancer, compared to approximately 41% for females. Predictions from the Canadian Cancer Society suggest that the burden of cancer will continue to rise dramatically over the next several years, perhaps as much as 79% between 2005 and 2030.

This is not because the risk factors are increasing, but rather because cancer detection methods have improved in assessing a population that is expanding and aging at the same time. Although cancer can occur in childhood and adolescence, it is relatively infrequent. Advancing age is one of the most significant risk factors: 89% of Canadians who acquire cancer are over the age of 50. The statistics also predict that the proportion of Canadians aged 65 and over will increase from 13% to 22% in the years spanning 2005 to 2030, suggesting by extension that there will be higher rates of cancer as well (Canadian Cancer Society, 2015).

Skin cancer is the most common cancer in Canada. In 2014, there were an estimated 82,600 new cases of skin cancer, which accounts for nearly the same number of new cancer cases as lung, breast, colorectal and prostate cancers combined. Fortunately, most skin cancers (76,100) are of the less aggressive basal cell and squamous cell varieties, which have a relatively high survival rate: there were only 440 deaths in this category. Cutaneous melanoma on the other hand is a much more serious disease. In 2014, there were an estimated 6,500 new cases of melanoma and 1,050 deaths, reflecting the aggressive nature of this illness. Cancers of the skin are one of the most preventable types of cancer, as ultraviolet radiation from overexposure to sunlight or indoor tanning beds is the major risk factor. Unfortunately, the incidence of melanoma continues to rise in Canada by approximately 2% per year, reflecting the need for sun safety awareness and skin cancer screening and prevention strategies nationally (Canadian Cancer Society, 2015).

Lung, breast, colorectal and prostate cancers constitute the next four most common cancers in Canada. Together, these four major types account for more than half (52%) of all total new cases of cancer in Canadians. Among these, lung cancer is the most common, with a projected 26,100 new cases affecting 13,400 males and 12,700 females and accounting for about 20,500 deaths in 2014. Lung cancer has a relatively poor 17% five-year survival rate because most cases are diagnosed at an advanced, inoperable stage and lung cancer cells by nature are aggressive and typically treatment resistant (Canadian Cancer Society, 2015). Fortunately, lung cancer is one of the most preventable diseases and the incidence rate has begun to drop steadily as tobacco consumption continues to decline in popularity.

Breast cancer is the next most frequent type, affecting approximately 24,600 individuals in Canada (24,400 females and 210 males), with an expected 5,100 deaths. One in nine females are expected to develop breast cancer at some point during their lifetime and 1 in 30 are at risk of ultimately dying of this disease. Fortunately, the breast cancer mortality rate has been declining since the mid-1980's due to increased awareness and early detection by mammography screening programs (Canadian Cancer Society, 2015). The prognosis continues to improve for breast cancer patients with the advent of more effective surgical techniques and chemo and radiotherapy regimens, in addition to improved support strategies such as bone marrow growth factors and antibiotics. The relative five year survival rate for females diagnosed with breast cancer has risen to 88% in Canada, while the incidence rates have remained stable since 2004.

Colorectal cancer is the next most frequent malignancy in Canada, affecting approximately 13,500 males and 10,800 females for a combined total of about 24,400 new cases and 9,300 deaths annually. About one in 15 Canadians are likely to develop colorectal cancer at some point during their life time and one in 28 will die from it (Canadian Cancer Society, 2015). The aggressive nature of colorectal cancer is reflected by the fact that it is the second most common cause of cancer death for males and the third most common cause of cancer death for females, with a relative five-year survival rate of 64% overall. Fortunately, the incidence rate for colorectal cancer has continued to drop by about 2% per year in Canada, owing to more effective screening strategies combined with improved surgical techniques and chemotherapeutic regimens. Similar to lung, breast and prostate cancers, colorectal cancer is strongly linked to modifiable lifestyle factors such as physical inactivity, obesity, smoking, and a diet low in fiber and high in fat, animal protein and refined sugars.

Prostate cancer is the leading type of cancer in Canadian males with an estimated 23,600 new cases and 4,000 projected deaths in 2014. It should be noted that prostate cancer is so common in males in Western society that some consider it a normal consequence of advancing age. One in eight Canadian men will be expected to develop clinically significant prostate cancer at some point during their lifetime and one in 28 will succumb to this disease. Fortunately, the incidence rate for prostate cancer has been declining steadily by about 3.2% per year since 2006, and the five-year survival rate remains relatively high at 96% overall (Canadian Cancer Society, 2015).

In the ten years leading up to 2009, over 810,000 Canadians, or 2.4% of the population, had been diagnosed with some form of cancer and were still alive by that date. This population included individuals who were actively undergoing cancer therapy, recovering from the effects of treatment, or coping long-term with the physical, emotional and spiritual consequences of having had cancer. Among these survivors, the largest groups included men in the 70-79 year category who had been diagnosed with prostate cancer, and women aged 60-69 who had been diagnosed with breast cancer; categories which together accounted for 40% of the prevalent cancer cases in Canada. These numbers reflect the fact that breast and prostate cancers are relatively common and have a more optimistic long term prognosis than more aggressive diseases such as colorectal and lung cancer, which accounted for only 13% and 5% respectively, of the prevalent cancer cases during that period (Canadian Cancer Society, 2015).

The 2015 Canadian Cancer Statistics encompass the incidence, trends and mortality rates of some 20 different types of cancer. However, just the most prevalent varieties have been discussed in this section as they have relevance with respect to cancer in the firefighter population. As will be outlined in the next section, firefighters are prone to the same general types of cancers as the Canadian public, albeit at higher incidence and mortality rates.

In summary, it is apparent from the data that the average Canadian citizen is at high risk of acquiring cancer at some point during their lifetime or ultimately dying of this disease. Although considerable strides have been made in terms of understanding, diagnosing and treating cancer, the most durable and cost effective strategy for controlling this disease lays in knowledge and

awareness of the risk factors in combination with cancer screening and other prevention strategies. This reality raises the complex but critical issue of personal accountability as it relates to lifestyle factors in relation to cancer risk. For example, smoking and an inactive lifestyle are perhaps the single greatest avoidable risk factors for many types of the most common malignancies. Further, maintaining a healthy weight with a diet high in fruit and vegetables and low in refined sugar, alcohol, animal fat and protein will help in the prevention of many of the most prevalent cancers in Canada and worldwide (Canadian Cancer Society, 2015).

## Cancer Incidence and Mortality in Firefighters

In order to appreciate the elevated risk that firefighters face concerning cancer, it must first be recognized that at baseline, even the average Canadian citizen is at high risk for cancer (Canadian Cancer Society, 2015). Firefighters, while having the same basic risk factors as the standard population, face additional exposures and stressors that render them in even greater peril of acquiring or dying of cancer.

In the course of their duties, and over a span of many years, firefighters are repeatedly exposed to complex mixtures of concentrated carcinogens which are generated and aerosolized in the heat and pressure of a fire. The thermochemical decomposition of organic and inorganic materials, such as the synthetic plastics, petroleum products, chemicals and metal alloys found in modern construction materials, furniture and buildings, is believed to yield potentially thousands of toxic combustion products. Benzene, polycyclic aromatic hydrocarbons, formaldehyde, dioxins, polychlorinated biphenyls, vinyl chloride, acrolein, asbestos and heavy metals such as lead, arsenic, and cadmium are only a few of the carcinogens detected in the smoke, soot, and tar generated by burning structures (Landrigan, 2004; International Agency for Research on Cancer, 2010). Furthermore, even a state-of-the-art outfit of personal protective equipment complete with self-contained breathing apparatus provides insufficient protection against these carcinogens: many firefighters anecdotally report that they smell like smoke or burning plastic for days after fighting a blaze, despite attempts at decontamination procedures. Fire investigators are at particular risk, as they sometimes work for days or weeks in the off-gassing debris of burned out and collapsed structures during the course of a fire investigation.

The carcinogens encountered during the course of a fire can be inhaled through the lungs, inadvertently swallowed via the upper aerodigestive tract, or absorbed in significant concentrations directly through the skin. Exposures can occur in the vicinity of an active fire, during overhaul and after the fire when firefighters remove and handle contaminated bunker gear, fire equipment, or ride in vehicles coated in fire-generated resins and soot (Firefighter Cancer Support Network, 2013).

In addition to the risk factors outlined above, another mechanism of carcinogenesis involving the circadian clock genes (Wood, 2009) has been described that may be at play in the fire service. Most firefighters experience disruption of sleep-wake cycles through working rotating or extended shifts, a phenomenon which has recently been classified as a carcinogenic by the International Agency for Research on Cancer (International Agency for Research on Cancer, 2010).

A number of large and statistically significant epidemiologic studies evaluating cancer in the fire service have appeared in the medical literature over the last several years (International Agency for Research on Cancer, 2010; Daniels, 2014; Daniels, 2015; Pukkala, 2014; Zeig-Owens, 2011; Ma, 2006; LeMasters, 2006). These studies consistently show elevated incidence and mortality rates of many types of cancers in firefighters when compared to the general public. In one of the largest and most ambitious of these (Daniels, 2014), a pooled cohort of 29,993 firefighters was followed over a span of nearly sixty years and it was found that overall, firefighters developed nine percent more cancers of all types, and were 14% more likely to die of cancer than age-matched controls in the general population. While these increased rates of 9% incidence and 14 percent mortality may seem modest, when they are taken superadditively with the baseline cancer rates of the general public, the overall effect becomes alarming. For example, the average Canadian male has a 45% lifetime chance of developing cancer (Canadian Cancer Society, 2015). This risk rises to 54% if that individual happens to be in the fire service. Similarly, if the average male has a 29% lifetime probability of dying from cancer (Canadian Cancer Society, 2015), this figure rises to 43% if that individual happens to be a firefighter.

The significance of these increased cancer rates is further magnified when considered in context to a well-known phenomenon called *the healthy worker effect*. This principle states that firefighters are thought to have better overall health when compared with the general population because of medical examinations and fitness requirements for entering and remaining in the fire service. Daniels *et al* (Daniels, 2014) showed that while firefighters were significantly less likely to die of many of the common, age-associated chronic illness that effect society at large, they were paradoxically more likely to die of cancer. For example, the cohort of firefighters studied were 20% less likely to die of non-malignant respiratory diseases, 9% less likely to die of stroke, 28% less likely to die of complications from diabetes, 20% less likely to die of neurological disorders and 39% less likely to die of alcohol related disease. In contrast, they were 100% more likely to die of mesothelioma, 39% more likely to die of esophageal cancer, 31% more likely to die of colon cancer, and 29% more likely to die of kidney cancer than the general public, to cite only a few examples from the study.

As proof of concept, in a subsequent report that builds upon the findings of their previous study, Daniels and his group (Daniels, 2015) were able to establish statistically significant exposure-response relationships between the number of fire-runs and fire-hours for each firefighter and their subsequent likelihood of dying of either lung cancer or leukemia, at some point later in life.

Pukkala et al (Pukkala, 2014) recently reported similar cancer incidence rates in a pooled cohort of 16,422 male firefighters from the five Nordic countries followed over a span of 45 years. In this

study, the firefighters were shown to be 6% overall more likely to be diagnosed with cancer of any type, but older firefighters were 159% more likely to get mesothelioma, 90% more likely to get adenocarcinoma of the lung, 69% more likely to get myeloma, and 40% more likely to be diagnosed with non-melanoma skin cancer than age-matched controls from the general Nordic population. Younger firefighters in this study were 62% more likely to be diagnosed with melanoma and 159% more likely to develop prostate cancer than the general public.

The 9/11 World Trade Center disaster provided an unfortunate but unique opportunity to study the short term effects of a single massive carcinogenic exposure applied to a set of 8,927 male firefighters (Zeig-Owens, 2011). The study, which is ongoing, found that within seven short years following the collapse, exposed firefighters had a 10% higher overall cancer incidence than the general male population, and about a 32% higher cancer incidence when compared to non-exposed firefighters. This unprecedented disaster established a new paradigm of disease in firefighters: the relatively rapid evolution of a wide variety of aggressive malignancies in otherwise young, healthy, and physically fit individuals which arose out of a single, massive exposure to the carcinogenic elements of a complex fire scene. Although 343 firefighters died on the fire ground that day, one wonders how many more of this cohort will succumb to cancer as they are followed further out in the ensuing years of the study.

Few studies with a large enough data set are available to evaluate the cancer risk to female firefighters, as females comprise only about 3.3% of the workforce in the fire service (Daniels, 2014). Thus it is a challenge to obtain sufficient numbers to generate data of statistical significance. The study conducted by Daniels et al, reported on the health of 991 female firefighters (Daniels, 2014). In this cohort, overall cancer incidence was elevated by 24% above that expected in the general public. However, only 40 cases total of cancer were reported, thus the figure, while indicative of a trend, was not large enough to reach statistical significance. Nevertheless, nearly half of all cases were breast cancer (N=18), and most cancer deaths in the female firefighters of this study were due to breast cancer. The overall bladder cancer incidence and mortality rate in female firefighters was elevated as well, but based on few numbers (N<5).

A large study examining the cancer incidence in Florida professional firefighters from 1981 to 1999 contained a more substantial subgroup of female firefighters (Ma, 2006). Among 2,017 female firefighters studied, 52 cases of cancer were reported, which constituted a 63% elevation above that expected from women in the general Florida public. Cervical cancer, thyroid cancer and Hodgkin lymphoma were all increased several fold above what would be expected, with numbers that were sufficient to reach statistical significance.

Although cancer incidence and mortality rates in female firefighters have been shown to be elevated, larger, longer and more comprehensive studies specifically dedicated to following female firefighters are vitally needed to direct health policy, resource allocation and screening and prevention as it concerns cancer and women in the fire service.

In summary, a number of recent, large epidemiological studies have confirmed a positive relationship between the occupation of firefighting and increased cancer incidence and mortality rates. In their study, Daniels et al. conclude that the pooled data (San Francisco, Chicago and Philadelphia firefighters), large sample sizes, and long follow-up periods make these findings robust and generalizable to similar firefighter populations across other geographic areas.

Therefore, with a relationship between firefighting and cancer confirmed, it would be a logical extension to begin anticipating and planning for higher rates of cancer in firefighters in the future. This might involve implementing programs to heighten awareness and education, both within the medical profession and the fire service, along with initiation of earlier cancer screening and prevention strategies as detailed below.

The Canadian Task Force on Preventative Health Care (CTFPHC) and the United States Preventative Services Task Force (USPSTF) both have current recommendations for screening asymptomatic adults from the general population for the most common types of cancers. Screening individuals for breast and colorectal cancer is recommended by both agencies, and while the USPSTF recommends screening smokers with CT scans between the ages of 55 and 80 years for lung cancer, the CTFPHC is currently evaluating this recommendation in Canada. Cervical cancer screening is also recommended by both agencies, while screening for prostate cancer is now uniformly discouraged by both on the basis that many men are harmed, and few if any benefit from prostate cancer screening (Canadian Task Force on Preventative Health Care).

Although most cancers are thought to be random or 'sporadic', it is estimated that about 5 to 10% of all cancers are related to inherited, germline cancer genes that run in families. Firefighters who have a strong family history of cancer should be at even heightened awareness and seek cancer screening and surveillance strategies according to published recommendations (American Cancer Society; United States Preventative Services Task Force).

## Cancer Screening in the General Population

The Canadian Task Force on Preventative Health Care (CTFPHC) and the United States Preventative Services Task Force (USPSTF) both have current recommendations for screening asymptomatic adults from the general population for the most common types of cancers. Screening otherwise healthy individuals for breast and colorectal cancer beginning at age 50 is recommended by both agencies, and while the USPSTF recommends screening smokers with CT scans between the ages of 55 and 80 years for lung cancer, the CTFPHC is currently evaluating this recommendation in Canada. Cervical cancer screening is also recommended by both agencies, while screening for prostate cancer is now uniformly discouraged by both on the basis that many men are harmed, and few if any benefit from prostate cancer screening (Canadian Task Force on Preventative Health Care). At the present time, the cancers listed above are the only cancers for which screening is currently recommended.

## Cancer Screening in Firefighters

As previously discussed, for persons at standard risk for cancer it is generally recommended that screening strategies such as colonoscopy and mammography begin at age fifty. However, because of the carcinogenicity associated with firefighting, some experts have recommended that firefighters assume cancer screening programs in the same manner as high risk individuals, such as those with a previous personal history of cancer or first degree relatives diagnosed with cancer. Firefighters have been encouraged to begin cancer screening programs at age forty, or ten years before the youngest case of cancer diagnosed in the immediate family.

An initial screening program for firefighters might involve a comprehensive physical examination, laboratory tests including complete blood count, serum chemistries, urinalysis and a bowel investigation such as endoscopy, CT colonography or fecal blood analysis. The screening of female firefighters could additionally include mammography, bimanual examination and Pap test. Certainly any signs or symptoms in a firefighter such as cough, unexplained weight loss, irritative voiding symptoms or blood in the stools should be taken seriously and followed through to either resolution or definitive diagnosis.

Although most cancers are thought to be random or 'sporadic', it is estimated that about 5 to 10% of all cancers are related to inherited, germline cancer genes that run in families. Firefighters who have a strong family history of cancer should be at even heightened awareness and seek cancer screening and surveillance strategies according to published recommendations (American Cancer Society; U.S. Preventative Services Task Force).

In the appendix section of this publication is a sample letter that firefighters are welcome to print out and take to their primary care physicians in order to initiate a cancer screening and surveillance program.

## Understanding Cancer Risk within the Profession of Firefighting

It is clear from the extensive research that has been conducted that the incidence and mortality rates associated with some forms of cancer have fallen as earlier screening and treatment strategies continue to advance. However, at the same time incidence and prevalence of cancer diagnoses are increasing in part due to expanded public awareness and screening opportunities as well as a multitude of environmental and other factors. While each cancer has its own myriad of risk elements, there are a number of generally accepted risk factors, as highlighted above, that most researchers and medical professionals agree are associated with prevention and contraction. Some of these factors are more specifically related to occupational characteristics while others are more generic but are aggravated by membership in certain professions, such as the fire service. It is this latter category that will be the focus of this report; however, there are some comments that should be made about these more specific occupational issues.

There are a variety of risk factors specific to the occupational requirements of firefighting that need to be addressed continually to ensure further improvements in the protective measures that have already been taken. As highlighted above in the discussion of particular forms of cancer, these risk factors include but are not limited to: exposure to exhaust, carcinogens, and soot; sleep deprivation; and physical exertion. Measures that have been taken to address these issues include: enhanced ventilation systems in garage bays; improved turn-out gear and breathing apparatus; more sophisticated cleaning procedures for gear; and, organizational changes addressing shift configuration and deployment strategies. All of these initiatives are contributing to gradual shifts in the fire service and consequently lessening the prevalence of particular risks; however, there continues to be a juxtaposition of the health concerns of firefighters with a complex milieu that can complicate the introduction of more progressive, protective measures (Jahnke, 2012).

While more specific occupational circumstances such as exposure to various pollutants are critical to framing a path forward, the focus of this report is on the challenges and opportunities linked to more general risk factors as they specifically relate to firefighters and the context within which they work. It is the contextualization of these more generic behaviours within the fire service that is fundamental as wellness programs and prevention and intervention strategies are explored and implemented. The five factors that are most often cited by cancer prevention programs and that will be discussed below in the context of the fire service are: tobacco use, obesity, diet, alcohol use, and exercise.

## **TOBACCO USE**

Current statistics from the Canadian Cancer Society reveal that approximately 4.2 million Canadians, or 14.6% of the population, were active smokers as of 2013 (Canadian Cancer Society, 2015). A recent report from the *New England Journal of Medicine* suggests that mortality among smokers is 2 to 3 times higher than among persons who have never smoked. Furthermore, the study shows that tobacco consumption is deadlier than previously thought, as many other life-threatening diseases aside from cancer were a result of the long term effects of cigarette smoking. Endeavors to control tobacco consumption must remain a matter of grave concern, especially in higher risk groups such as firefighters (Propel Centre for Population Health Impact, 2015; Carter, 2015).

There are a number of studies that indicate that while firefighters are less likely to be smokers than the general population; once smokeless tobacco use and dual use is included, firefighters are more likely to engage in these behaviours than the general population (Poston, 2013). When examined as a coping mechanism within a highly stressful occupational setting, the high levels of smokeless tobacco and dual use seem more understandable. Importantly, like tobacco users, users of smokeless products are more likely to be involved in various unhealthy behaviours including poor nutritional habits and heavy drinking.

Additionally, it appears that firefighters who are smokers are less likely to indicate an intention to quit smoking which, in an anti-smoking society, may be explained by their higher levels of occupational stress. There are particularly interesting layers of this relationship when examining the patterns of smoking by female firefighters who because of their gender face even higher levels of stigmatization and yet are also well above the general population in rates of smoking. Of the firefighters who quit smoking, those more likely to start smoking again were also more likely to engage in regular consumption patterns of alcohol. While there is little research in the area of smoking cessation and firefighters specifically, it would appear based on its relationship to drinking that more needs to be done to understand and develop healthy approaches to dealing with occupational stressors that predispose these workers to unhealthy choices.

Importantly, there is evidence to indicate that general cancer awareness and health education programs are not an adequate response to the particular dynamics that prompt and sustain tobacco use among firefighters. There needs to be a causative model employed that examines the precursors to tobacco use among firefighters and develops a sustainable attitudinal and behavioural change orientation framed by meaningful organization and industry introspection.

## **OBESITY**

According to the World Health organization, obesity has become a global health epidemic and has been linked to diabetes, hypertension, cardiovascular disease and many forms of cancer (World Health Organization). In Canada, obesity rates have tripled between 1985 and 2011 (Twells, 2014), and it is currently estimated that about 24% of Canadians are obese with rates continually on the rise (Statistics Canada, 2013).

Research indicates that in addition to the use of tobacco and smokeless tobacco and binge drinking, firefighters experience concerning levels of nutritional and weight issues (Poston, 2013). In particular, the fire service ranks near the top of male-dominated professions in terms of rates of obesity (Poston, 2013). In a profession that is viewed by outsiders as physically demanding this trend needs to be examined within a context of a variety of occupational factors including: low workflow control, highly variable shift experiences (i.e. sedentary to high adrenaline), fewer physically demanding calls, poor dietary and nutritional habits (discussed below), and low involvement in fitness oriented leisure activities. All of these factors heighten the risk of obesity and need to be addressed through a comprehensive and innovative workplace orientation to wellness.

In an exploration of the levels of understanding of particular health risk and fitness levels, there was evidence of an inverse relationship whereby firefighters were increasingly less likely to have accurate assessments of their BMI and consequently their risk for conditions related to obesity (Staley, 2011). It is this raising of awareness that is made more difficult within a professional milieu that is characterized by larger than life personalities, bravado, self-deprecating humour, and a general resistance to change.

## **DIET**

Related to the particular problem of obesity but broader in scope are the dietary deficiencies of individuals generally and firefighters specifically. In fact, the Canadian Cancer Society estimates that about one-third of all cancers are related to diet and physical activity (Canadian Cancer Society). Behaviours that are particularly problematic within the fire service include: consuming meals quickly due to a conditioned anticipation of the next call; making less healthy meal and snack choices in part associated with male culinary predispositions; engaging in overtime through picking up extra shifts; and, irregular meal times (Choi, 2011).

The sense of community that comes with firefighters eating together and consuming meals that are hearty yet not necessarily healthy is well documented (Jahnke, 2012). While the organization of food consumption presents challenges, the importance of the kitchen and the preparing and sharing of meals in fire halls is one of the most predictable aspects of the fire hall and consequently presents an equally compelling opportunity for attitudinal and behavioural change.

As one of the generally agreed upon factors that can be addressed to reduce the likelihood of developing cancer, dietary dynamics within the fire service present an important site for organizational change in regard to healthier work spaces. In departments that have implemented robust wellness programs, there is evidence that the preparation and consumption of healthy meals and the sense of community that they support act as recruiting grounds for program buy-in. In other words, the same dynamics that contribute to solidarity in the development and maintenance of negative attitudes and behaviours so too act as binding agents to the health and wellness ideas that are being promoted in some departments.

## **ALCOHOL USE**

There is ample evidence to support the assertion that there are higher rates of heavy drinking and binge drinking within the fire service when compared to the general population (Haddock, 2012). The relationship between cancer and alcohol consumption is equally well documented (Geisbrecht, 2007).

The relationship between alcohol and attempts to cope with stress need to be understood within a complex web of factors including length of service, familial and social relationships, sleep and nutritional patterns, and exercise (Piazza-Gardner, 2014). Understanding alcohol use as a coping strategy affirms the need to address these and other risk factors from a preventative angle that examines the culture of the fire service as it is characterized by the duties, history, changing expectations, personnel, and public expectations that shape its members.

## EXERCISE

Despite the public image of the firefighter, there are numerous studies that indicate that there are lower levels of physical fitness among firefighters and that this risk factor, like the others, needs to be understood as being a result of both direct and indirect occupational factors. There are contextual issues related to the types of calls that firefighters are responding to including, most importantly and increasingly, a lower proportion of their work being associated with high exertion fire calls and an increasing proportion of their calls being in response to medical calls.

While there needs to be more research conducted in relation to the specific elements of these calls as they relate to stress (differentiating between during and post call) and levels of physical exertion it seems reasonable to posit that these factors have a potentially deleterious effect on the health of firefighters (Choi, 2011). Additionally, it seems reasonable that these shifts in call types will exacerbate the differentiation between the nature of the workload at slower versus busier fire halls and consequently issues of physical fitness, nutrition and stress and associated coping strategies (e.g. smoking and drinking) need to be understood within this context of change.

While there are certain challenges that are presented by the closely knit and largely traditional orientation of the fire service, the solidarity embedded in this milieu also provides some opportunities to promote positive nutritional and exercise habits. Various wellness initiatives have taken hold and proliferated due to group norms within the fire service that emphasize competitiveness, collegiately, solidarity, and interestingly enough, humour (Mabry, 2013). These findings provide compelling fodder for the development of rank and file support for both risk recognition and behavioural change programs with respect to health awareness generally and cancer awareness specifically. Higher levels of physical fitness are associated with positive sleep patterns, both of which are associated with improved job performance (Airila, 2012).

In conclusion, all of these factors are importantly and intricately connected and must be dealt with accordingly; however, understanding them as individual factors is instructive as strategies are designed. Clearly, there are specific occupational risk factors that need to be better understood and ameliorated through enhanced training programs and protective equipment. However, addressing these five more generalized health factors within the fire services' particular milieu would be a progressive response to the higher cancer risks experienced by firefighters.

## Looking Forward

One of the most critical issues in moving any program of change forward is to better understand and address the relationship between firefighting profession and membership and administrative understandings of particular health risks and ameliorative strategies addressing those risks (Staley, 2011).

There are some who argue that “unhealthy behaviours in emergency services personnel may be considered a result of the mental and physical burden typically associated with their daily work and which is virtually impossible to eliminate” (Pawel, 2013). However, it is perhaps more important to note that it is exactly this stressful environment that necessitates more proactive intervention and alleviation measures that have until relatively recently not taken into account the particular challenges and opportunities presented by the fire service. One of the aspects of the fire service that challenges these approaches is a hyper-masculine orientation that has been associated with the profession and may contribute to resistance to prevention orientations whether in relation to safety gear and method (Nielsen, 2015) or health and wellness initiatives.

The media has highlighted the presumptive cancer and health insurance debate and this is without question an important piece of the puzzle; however, the cancer statistics introduced at the beginning of this report indicated that the general population is at a high risk of developing cancer and while the fire service has higher rates in relation to certain forms of cancer, the focus on presumptive cancer is only a partial construction of the problem and arguably may distract stakeholders from important discussions of institutional change as a catalyst for cancer prevention within the fire service.

While “there have been a limited number of firefighter health promotion programs that have been developed and empirically-tested for this important occupational group”, there is evidence that meaningful wellness initiatives implemented in fire departments have the potential to positively impact the physical, emotional and mental health of its members in measurable and sustainable ways (Poston, 2013). These wellness programs are the most important part of this conversation as prevention through heightened levels of awareness, understanding and meaningful behavioural change is fundamental to lowering the cancer risk levels for firefighters. Firefighters with a personal history of cancer, or one or more first degree relatives with cancer are even in greater jeopardy of getting cancer while employed in the fire service. It is only through an approach to wellness that emphasizes personal accountability in conjunction with organizational leadership that meaningful and sustainable attitudinal and behavioural changes will occur.

A multi-pronged approach that addresses both cancer prevention and intervention strategies is essential. This approach would include, but not be limited to:

- coherent and meaningful pre-screening protocols;
- modifications to the physical plant of the fire hall;
- further research and design in relation to firefighting equipment and method that lessen exposure to cancer-causing agents;<sup>1</sup>

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<sup>1</sup> Given the potential hazards firefighters, should be encouraged to adopt a more informed risk versus reward proposition given the evidence that combined and repeated exposures to contaminants have the potential to elevate the risk of contracting various cancer. Incident commanders often have to choose between offensive and defensive operations and when no lives are at risk, they typically take a defensive approach (e.g. attacking from the exterior), rather than an offensive approach (entering the building) in extinguishing the fire. An offensive approach should generally be limited to instances where lives are at risk (e.g. someone is trapped in the building).

- organizational changes that reduce the likelihood that firefighters will continue to rank so highly on key lifestyle risk factors;
- comprehensive extended health care coverage that emphasizes access to services and programs related to prevention including meaningful screening initiatives;<sup>2</sup>
- incorporation of presumptive cancer policies where appropriate; and most critically,
- health and wellness programs that provide educational and behavioural opportunities to engage in healthier living.

It is clearly time for a more progressive and holistic approach to health and wellness in the fire service. In the past these efforts have been rooted in more generalizable approaches that did not recognize the particular aspects of the fire service culture that make it more resistant to traditional awareness and behavioural change models.

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<sup>2</sup> For persons at standard risk for cancer, it is generally recommended that screening strategies such as colonoscopy and mammography begin at age fifty. However, because of the carcinogenicity associated with firefighting, some experts have recommended that firefighters assume cancer screening programs in the same manner as someone with a first degree relative with the disease. Firefighters have been encouraged to begin cancer screening programs at age forty, or ten years before an affected first degree relative. An initial screening program might involve a comprehensive physical examination, laboratory tests including complete blood count, serum chemistries, urinalysis and a bowel investigation such as endoscopy, CT colonography or fecal blood analysis. The screening of female firefighters could additionally include mammography, bimanual examination and Pap test. Certainly any signs or symptoms in a firefighter such as cough, unexplained weight loss, irritative voiding symptoms or blood in the stools should be taken seriously and followed through to either resolution or definitive diagnosis. (See Appendix A)

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Larry Thomas is a Deputy Fire Chief of Operations for the City of Surrey, BC with 26 years' experience and is the Manager for Training with a background in Science from Simon Fraser University and Economics from Douglas College. Contact him at [Lstomas@surrey.ca](mailto:Lstomas@surrey.ca)

## Appendix A

### FIRE CHIEFS' ASSOCIATION OF BC

871 Oakview Street,  
Coquitlam, BC V3J 4T6,  
Phone: 604-492-3080 Email: [fcabc@shaw.ca](mailto:fcabc@shaw.ca)

Dear Doctor,

The purpose of this letter is to provide information on *cancer screening and surveillance* for firefighters and emergency responders that may wish to establish a health maintenance program under your care. WorkSafeBC has recognized the growing body of scientific literature linking firefighting to a variety of job-related cancers and has passed the *Cancer Presumption Relief Act* of 2005. This legislation currently provides for ten different cancers as being connected with the occupation of firefighting: leukemia, lymphoma, brain, lung, esophageal, colorectal, kidney, bladder, ureter, and testicular cancer. However, numerous reports indicate that these are not the only line-of-duty cancers that firefighters are at risk for<sup>1</sup>. Despite the correct use of personal protective gear, firefighters sustain intense and repeated exposures to highly variable mixtures of concentrated carcinogens. After inhalation, absorption through the skin, or inadvertent ingestion, these substances are widely distributed throughout the body. As a consequence, the tumours associated with firefighting are not limited to any specific organ system. Moreover, studies have indicated that the relative risk for these cancers can vary anywhere from 1.3 for prostate cancer, through 5.2 for cancer of the cervix in female firefighters<sup>2</sup>, to as high as 36 times the risk for kidney cancer in firefighters with 40 or more years of service<sup>3</sup>. New statistics generated from the World Trade Center disaster show that these cancers are often of an aggressive variety and present at an age earlier than expected<sup>4</sup>.

For persons at standard risk for cancer, it is generally recommended that screening strategies such as colonoscopy and mammography begin at age fifty. However, because of the carcinogenicity associated with firefighting, some experts have recommended that firefighters assume cancer screening programs in the same manner as someone with a first degree relative with the disease. Firefighters have been encouraged to begin cancer screening programs at age forty, or ten years before an affected first degree relative. An initial screening program might involve a comprehensive physical examination, laboratory tests including complete blood count, serum biochemistry, PSA, urinalysis and some type of bowel investigation such as endoscopy, CT colonography or fecal blood analysis. The screening of female firefighters could additionally include mammography, bimanual examination and Pap test. Certainly any symptoms in a firefighter such as a excessive coughing, unexplained weight loss, hematuria or blood in the stools should be taken seriously and followed through to either resolution or definitive diagnosis.

I hope that this information will be helpful in guiding your decisions regarding requests by firefighters to establish cancer screening and surveillance programs. Firefighters as a group are highly motivated individuals and it is a pleasure to assist them in strategies that will decrease the burden of cancer in our society.

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Date



