

**BC Coroners Service Child Death Review Panel  
A Review of Fire-Related Deaths in Children and Youth  
2005-2014**



REPORT TO THE CHIEF CORONER OF BRITISH  
COLUMBIA

March 2016

## PREFACE

On May 12, 2015, the British Columbia Coroners Service (BCCS) held a child death review panel focused on residential fire-related deaths of children and youth who died between 2005 and 2014.

In the 10 year period reviewed, 34 children and youth under the age of 19 years died in 22 residential fire circumstances. Their loss is deeply felt by family, friends and their communities. The review of the circumstances that resulted in their deaths provided panel members with valuable information to consider in the course of determining what could be done to prevent fire-related deaths in the future.

Panel support was provided by the BCCS Child Death Review Unit (CDRU). Adele Lambert, Will Speechley, and Holli Ward compiled aggregate case reviews and a review of the research and statistics which formed the basis of the panel discussions.

I am sincerely grateful to the following members of this panel for sharing their expertise, bringing the support of their respective organizations and participating in a collaborative discussion. Their contributions have generated action oriented recommendations that I am confident will contribute to reducing fire-related deaths in BC.

Dr. Tyler Black	BC Children's Hospital
Dr. Ian Pike	BC Injury Research and Prevention Unit
Don Jolley	Fire Chiefs' Association of BC
Gordon Anderson	Fire Commissioner, Emergency Management BC
Mark Smitton	Fire Prevention Officers' Association of BC
Stephen Gamble	Langley Fire Department
Brent Langlois	First Nations Emergency Services Society
Michelle Buchholz	First Nations Emergency Services Society
Wayne Schnitzler	First Nations Emergency Services Society
Marilyn Ota	First Nations Health Authority
Chris Welch	Ministry of Children and Family Development
Sherri Mohoruk	Ministry of Education
Dr. Shannon McDonald	Ministry of Health
Dr. Perry Kendall	Provincial Health Officer
Brendan Fitzpatrick	RCMP 'E' Division

On behalf of the panel, I submit this report and recommendations focused on preventing residential fire-related deaths in young people to the Chief Coroner of BC for consideration.



Michael Egilson  
Chair, Child Death Review Panel

## EXECUTIVE SUMMARY

Although the science of fire safety and fire prevention continues to evolve children in this province still die in residential fires. Their deaths have a profound impact on both their families and the communities in which they live. Apart from fatalities, fire related childhood injuries also have a lasting impact on those injured. Further compounding these tragedies is the recognition that the majority of residential fire deaths are preventable. The focus of this report is on actions that can be taken to prevent residential fire-related deaths among children. The implementation of these measures can also be expected to help reduce fire related injuries.

To better understand fire-related deaths in children and youth under the age of 19 and to identify prevention opportunities, a child death review panel appointed under the *Coroners Act* was held in May 2015. The review panel was comprised of professionals with expertise in fire prevention and suppression, medicine, child welfare, Aboriginal health, child injury, public health, education, and law enforcement.

The circumstances of 34 children and youth who died as a result of 22 residential fire-related incidents between 2005 and 2014 were reviewed in aggregate. Current research and statistics related to residential fires were assessed and key themes identified.

The review found that children under the age of 10 years were most at risk. Children in circumstances of substandard housing, overcrowding, with less adult supervision and in smoking environments are at greater risk. Of the 22 residential-fires reviewed, only eight homes were identified as having functional smoke alarms. Four of the 22 fires were attributed to fire play by young children accessing lighters or matches.

During this review the panel identified a lack of available data about residential fires in general as well as differences in data collection and reporting requirements between jurisdictions. Additionally, the review found a need for the consistent delivery of public information related to fire awareness, prevention and safety. The panel identified three key activities to reduce residential fire deaths:

- Develop provincially standardized fire safety education materials for **vulnerable** families and assess the effectiveness of these;
- Improve use of and access to smoke alarms specifically targeting vulnerable populations in partnership with family serving programs and agencies;
- Improve fire data collection and sharing of information about fire events and outcomes.

These findings are the basis for the following recommendations put forward to the Chief Coroner by the panel:

### **Recommendation 1: Fire Safety Education and awareness**

By December 2017, the Fire Commissioner in collaboration with the Fire Chiefs Association of BC (FCABC) and the Fire Prevention Officers Association of BC (FPOBC) to adopt, develop and utilize standardized provincial fire prevention/ safety training materials, including the Juvenile Fire Setter Program.

**Recommendation 2: Fire Safety Prevention**

By September 2016, the Fire Commissioner to work to expand partnerships with provincial programs and community agencies working with vulnerable families to improve access to and use of smoke alarms.

The Ministry of Natural Gas Development and Responsible for Housing, Office of Housing and Construction Standards to investigate the evidence and feasibility of mandating sprinkler system installation in new homes in the BC Building Code.

**Recommendation 3: Data Quality and Information Sharing**

By December 2017, the Fire Commissioner in collaboration with the Fire Chiefs Association of BC to identify common datasets (relevant to injuries/fatalities) for collection and incorporation into the fire reporting requirements and annual statistical reporting.

The Fire Commissioner to collaborate with appropriate national organizations to ensure consistency in data collection with the National Fire Information Database.

The BC Coroners Service share coroners' reports of fire-related deaths with police and fire officials in order to improve policy and best practices between the agencies.

## CHILD AND YOUTH FIRE DEATHS

No one ever expects to lose their child, family member or a friend in a residential fire. The following accounts emphasize the tragic consequences that can occur if the risk of fire is not recognized or is misjudged. Even if our lives have not been personally touched by a residential fire, many British Columbians have experienced a frightening encounter with smoke or flames and the shrill sound of a smoke alarm. The following two case stories represent common themes discovered in this review.

### YOUNG CHILDREN AND FIRE PLAY

*On an early summer morning, a 911 call reported a residential fire. When fire fighters arrived at the scene, they immediately entered the home to search for a child who had not been able to escape from the home. The child was found lifeless in a bedroom.*

*On the morning of the fire, parents were awoken by the cries of their children telling them the house was on fire, and that a sibling was trapped in the bedroom. The smoke was getting thick and the children were told to leave the house immediately. A parent attempted to put out the fire with water, but was unable to reach the child. The parent called to the child 'go to the bedroom window', before heat and smoke forced the parent from the house. Neighbours attempted to enter the residence through the bedroom window but the smoke and heat were too intense.*

*Following the young child's death, the coroner and Fire Services Investigation Unit reviewed the scene to determine what had caused the fire. The investigation found that the child had lived in a single storey family home and shared a bedroom with a sibling. It was learned that an older sibling had been playing with a lighter in the bedroom and some paper started on fire which ignited a mattress. It was thought that the child who died may have been asleep at the time of the fire which prevented the child from escaping from the room.*

*There was a smoke alarm in the home; however the alarm was not working at the time of the fire.*

### SMOKING MATERIALS

*Around 4:00 in the morning, a child awoke to the sounds of popping noises and called out to others in the house that there was a fire on the porch. One person went outside to try to extinguish the flames with a garden hose, while the child and several other people moved to a bedroom area to call 911.*

*Unknown to the child and the others the fire grew rapidly and engulfed the entire home. Friends and neighbors attempted to rescue those trapped inside by breaking a window, but the heat and flames were too intense. The rush of incoming air caused the flames to explode.*

*The fire had originated on a covered porch which contained a couch, and which was often used by the residents and friends as a smoking area. It is believed that a cigarette left unattended or not fully extinguished started the fire on or near the couch. The smoldering couch burned through the deck flooring, ignited the exterior wooden siding with the fire quickly spreading up the outside wall and throughout the attic of the house.*

*It is unknown whether there was a smoke alarm in the home. No alarm sound could be heard during the 911 call and the caller indicated having been awoken by popping sounds coming from the attic area. By the time the fire department had arrived the flames had spread though the attic and into the home, blocking any chance of escape. Three people died.*

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## PART 1: INTRODUCTION

Residential fires are the fifth leading cause of unintentional deaths in children, with children younger than 10 years of age being the most vulnerable. In British Columbia (BC) residential fires comprise approximately 30% of all fires reported, with homes (one to two family dwellings), apartments and mobile homes accounting for the majority of residential fires and the majority of fire deaths (Wijayasinghe, 2011).

However, fire related deaths are only one component of the impact of residential fires. Burns from fire and flames may cause significant injury and disfigurement. Provincial hospitalization data from 2006-2011 indicates that burns related to fires, flames and hot substances resulted in 317 hospitalizations for children up to 14 years with the highest hospitalization rate for children aged 0-4 years of age (BC Injury Research and Prevention Unit, 2012).

To better understand the issues related to fire-related deaths in children and to identify opportunities for prevention, a child death review panel appointed under the *Coroners Act* was held in May 2015. The circumstances of 34 children and youth who died as a result of residential fire-related incidents between 2005 and 2014 were reviewed in **aggregate**.

This review is based on 22 separate residential fires. In thirteen of these fires there were multiple fatalities of children and/or children and adults.

### DEATH REVIEW PANEL

A death review panel is mandated<sup>1</sup> to review and analyse the known facts and circumstances of deaths to provide the Chief Coroner with advice on medical, legal, social welfare and other matters concerning public health and safety, and the prevention of deaths. A death review panel can review one or more cases before, during or after a coroner's investigation, an inquest or a review by the BCCS Child Death Review Unit (CDRU), and regardless of any decision made by a coroner or member of the CDRU.

The *Coroners Act* mandates the review of all deaths of children under age 19 years. The Chief Coroner has established a child death review panel to meet on specific occasions throughout the year to provide recommendations on the prevention of child and youth deaths. This process is consistent with the child death review principles laid out by the Honourable Ted Hughes in his 2006 report<sup>2</sup>. The Chair of the CDRU was appointed chair of the child death review panel whose membership includes: CDRU coroners and professionals with expertise in: **Aboriginal** health, injury prevention, public health, medicine, child psychiatry, emergency health services, law enforcement, education and child welfare. In the course of reviewing children and youth residential fire-related deaths that occurred between 2005 and 2014, the panel reviewed:

- BCCS investigative findings;
- Academic and research literature;
- Information provided by panel members;
- Environmental, social and medical factors associated with the deaths;
- Possible trends or themes;
- The current state of related public policy and strategies; and
- Existing challenges.

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<sup>1</sup> Under the *Coroners Act*

<sup>2</sup> *BC Children and Youth Review, 2006*

Each panel member shared their professional perspective and the panel collectively identified actions aimed at preventing future residential fire-related deaths.

### **LIMITATIONS AND CONFIDENTIALITY**

The small number of children and youth who died as a result of fire presents challenges in accurately analyzing and reporting information while protecting personal privacy and data accuracy. Provisions under the *Coroners Act* and *Freedom of Information and Protection of Privacy Act* allow for the BCCS to disclose information to meet its legislative mandate and to support the findings and recommendations generated by the review process. For the purposes of this report, information is presented in aggregate form. Details that could identify the young people have been omitted to respect the privacy of the child who died and their families. The BCCS is sensitive to the privacy of children, families and communities that we serve and proceeds with caution when reporting case review findings.

## PART 2: INTERNATIONAL, NATIONAL AND THE BC CONTEXT

The following is an overview of published literature and research findings as well as public information about residential fires and potential strategies to reduce fire deaths. This includes general statistical information of the incidence of fire-related deaths and factors associated to these events. Much of the research is based on statistical data collected by fire marshals, fire commissioners, coroners and medical examiners.

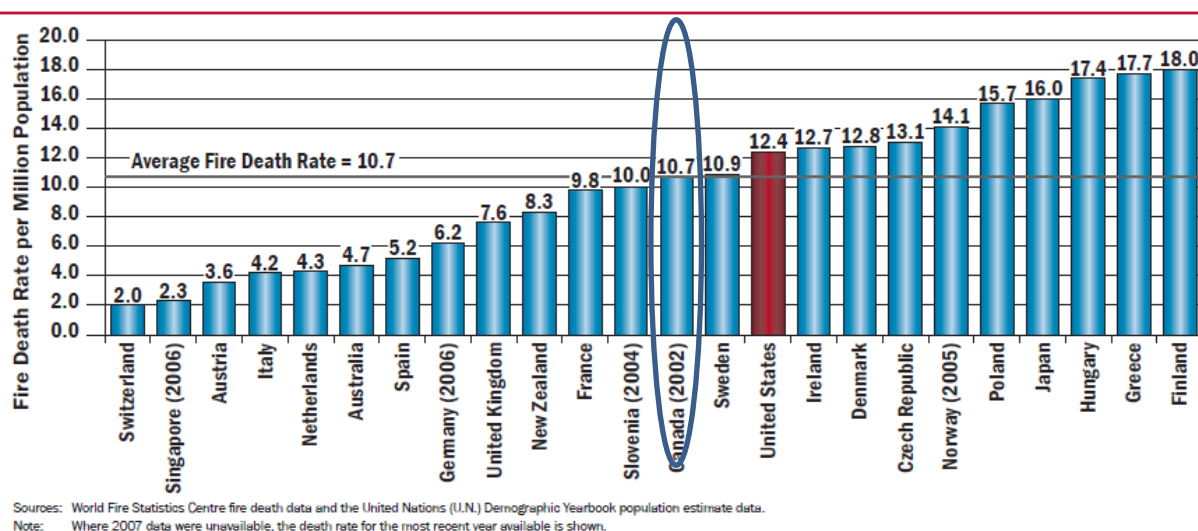
Overall, research shows that the risk of death due to a residential fire is influenced by a number of factors such as: a person's age, type of housing, socio-economic and lifestyle factors and the absence of functional smoke alarms and sprinkler systems.

It should be noted that information about the incidence of fires is limited and variances in data collection make it difficult to compare across jurisdictions. There are differences in record keeping, reporting and fire classification practices that make understanding non-fatal incidence of fires challenging to determine. These limitations highlight the need for further information to identify opportunities to reduce fire-related deaths.

### INTERNATIONAL

A 2014 report completed by the Geneva Association, an international think tank of the insurance industry, indicates a decreasing trend in fire deaths in countries (including Canada) between 1979 and 2007 (Geneva Association, 2014). This may be attributed to improved building practices and regulations, public awareness and education and the use of fire prevention practices (US Department of Homeland Security, 2011). Data from 2007 illustrates differences in fire death rates for 22 countries (see figure 1).

Figure 1 - 2007 International Fire Death Rates per Million Population



Source: US Fire Administration

In the United States, the U.S. Fire Administration reported that from 2010 to 2012 there were approximately 2,400 fatalities of civilians in 1,700 residential fatal fire incidents (U.S. Fire Administration, 2014). Children younger than 10 years old and children and youth between 10 and 19 years old accounted for 12% and 4% of the fatalities respectively (U.S. Fire

Administration, 2014). U.S. data also indicate that burns are the third leading cause of unintentional injury in the home and that the majority of burn fatalities are due to inhalational injuries.

## CANADA

In Canada, nation-wide statistical data specific to residential fire losses is quite dated. A 2011 report to the Council of Canadian Fire Marshals and Fire Commissioners (CCFM/FC) based on provincial/territorial data<sup>3</sup> (years 2003-2008) found that of 42,000 fires reported, 30 percent were home fires (Wijayasinghe, 2011). The report also indicated that home fires accounted for 67 percent of all fire deaths and that:

- Cooking (20%) was the leading cause of home fires followed by heating equipment (12%) and arson (11%);
- Smoking (22%) was the leading cause of deaths in home fires followed by arson (9%), electrical (5%), cooking (5%) and child fire play (3%);
- 22% of home fires originated in the kitchen, causing 29% of injuries;
- 8% of home fires originated in the living room, causing 33% of deaths and 17% of injuries; and
- 9% of fires started in a bedroom, causing 20% of deaths and 21% of injuries (Wijayasinghe, 2011).

Statistics Canada data (2005-2011) of child and youth deaths due to accidental exposure to smoke, fire and flames<sup>4</sup>, indicated that age-specific mortality rates per 100,000, were highest for infants under 1 years old (0.5) and children ages 1 to 4 years old (0.8). For children age 5 to 14 years old the age-specific mortality rates was 0.1 per 100,000.

A recent study on health care costs of burn patients indicates that approximately 45,000 burn injuries occur in Canada each year, with about 2,000 patients requiring hospitalization. The study indicated that annual direct treatment costs of burn injuries is approximately 118 million dollars with indirect costs adding a further 172 million dollars (Banfield, Rehou, Gomez, Redelmeier, and Jeschke, 2015).

## BRITISH COLUMBIA

In British Columbia, BCCS data from 2005-2014 showed that for all ages fire is the fifth most common cause of accidental death, accounting for 2.1 percent of all deaths. For the same time period, fire was also the fifth overall cause of accidental death for children and youth, accounting for just under 5 percent of all deaths (see table 1).

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<sup>3</sup> BC, AB, MB, ON, NS, SK, NWT

<sup>4</sup> Statistics Canada, Table 102-0551

Table 1 – Percent of Accidental Deaths by Age in British Columbia, 2005 to 2014

Cause of Death	Percent of Accidental Deaths, Children 0-18 years old (2005-2014)
Motor Vehicle: Traffic	51.3%
Poisoning: Alcohol/Drugs/Other	9.0%
Drowning	7.2%
Falls	5.1%
Fire	4.6%

Source: BC Coroners Service

In addition, fire, flames and hot substances resulted in 317 hospitalizations for children age 0-14 years in BC (2006-2011). Hospitalization rates for children aged 0-4 years were 21.45/100,000 more than 4.8 times higher than children aged 5-9 years (BC Injury Research and Prevention Unit, 2012).

For burns caused by a fire in a building structure, data provided by the BC Injury Research and Prevention Unit (BCIRPU) from 2004/05 to 2010/11 found the rates were 1.67 per 100,000 for infants less than one years old and 0.35 per 100,000 for youth ages 15 to 19 years old (BC Ministry of Health and BC Injury Research and Prevention Unit , 2013)<sup>5</sup>.

## PART 3: LEGISLATION AND REGULATIONS

In BC, the *Fire Services Act* and the 2012 *BC Fire Code* are governed by the Office of the Fire Commissioner. The *Fire Services Act* provides the Fire Commissioner and identified staff with authority in relation to the investigation, prevention and suppression of fires. Bulletins produced by the Office of the Fire Commissioner provide direction and interpretation of the Act and its corresponding regulations.

The 2012 *BC Building Code* is a provincial regulation for new construction and building alterations and is based on the 2010 *National Building Code of Canada*. The BC code establishes the minimum standards for health, safety, accessibility, fire and structural protection of buildings and energy for BC. This code does not apply to First Nations communities or the City of Vancouver.

The City of Vancouver is governed by a fire bylaw and building bylaw which is based on the *BC Building Code*. The fire bylaw contains regulations that are enforced by the Vancouver Fire and Rescue Services (City of Vancouver, 2013). The Vancouver building bylaw is primarily based on the *BC Building Code* and *BC Plumbing Code*. This bylaw establishes minimum standards, including those for fire and structural protection of buildings (City of Vancouver, 2013).

First Nations communities are responsible for development and enforcement of bylaws, including building regulations for on-reserve housing. First Nation organizations, such as

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<sup>5</sup> No rates were available for children and youth in the age groups: 5 to 9 years and 10 to 14 years due to small numbers.

First Nations' Emergency Service Society in BC, provide support through Fire Protection Governance, which includes support for drafting/adopting the above bylaws.

A 2003 report by the federal Auditor General stated that "Substandard housing on reserves remains a problem.... While some First Nations have their own inspectors, others rely on tribal councils or inspection services controlled by First Nations. However, it is not always clear to what extent these inspections ensure compliance with the National Building Code" (Sheila Fraser, Auditor General April 2003).

Aboriginal Affairs and Northern Development Canada (AANDC) provides funding support to First Nations communities for on-reserve housing, including: construction, renovation, maintenance, and planning and management of their housing portfolio (Canada Mortgage and Housing Corporation).

## **FIRE AUTHORITIES AND SERVICES IN BC**

Fire authorities and services that provide fire protection services to the public include:

### ***A. Office of the Fire Commissioner***

The Office of the Fire Commissioner is the senior fire authority in relation to fire safety and prevention. Its functions include: enforcement of fire safety legislation; provincial monitoring, oversight and public reporting of fire loss; fire investigations and fire inspections; coordination of responses in major fire emergencies; provision of advice to local governments in relation to the delivery of fire related services; and public education and firefighter training standards.

### ***B. Firefighting Services***

Local governments are responsible for the decision to have a fire department in their community. This includes evaluating the need for services, providing required resources and assessing their department capabilities. The cost of a fire service is the responsibility of local residents through taxation or in some cases, donation.

A report by the Fire Services Liaison Group (FSLG) indicates there are approximately 350 independent and community-based volunteer and career fire departments across BC (this does not include First Nations, federal fire forces and industrial forces). These departments are comprised of both volunteer (approximately 10,000) and career (approximately 4,000) firefighters. Of the total 350 departments, approximately 180 operate in municipalities and regional districts and 170 operate in unincorporated areas under direction from improvement districts or societies (Fire Service Liaison Group, 2009).

### ***C. First Nations Firefighting Services***

As previously mentioned, AANDC provides core capital funding on an annual basis to First Nations Band Councils who are responsible for managing fire protection services on reserve. First Nations communities may establish their own fire department or contract fire protection services from a community close by. Most First Nations Fire Departments are volunteer based (Langlois, B., 2015). Fire protection services may include equipment and fire halls, training and education. Additionally, the AANDC provides funding to the Aboriginal Firefighters Association of Canada (AFAC) to assist with fire prevention awareness and training initiatives. AFAC is a national body comprised of regional First Nations Fire Protection Associations across Canada (Aboriginal Affairs and Northern Development Canada).

In June 2010, the First Nations Fire Protection Strategy 2010-2015 document was developed by AANDC (then Indian and Northern Affairs Canada), AFAC and various First Nations regional organizations (Aboriginal Affairs and Northern Development Canada, 2010). The primary focus of this strategy is fire protection for on-reserve communities in addition to creating linkages among First Nations populations, national and regional firefighter associations and promoting the development of municipal agreements for First Nations communities both on and off-reserve. Key activities of this strategy include: promoting fire safety; strengthening fire safety inspections; and modernizing service standards (Aboriginal Affairs and Northern Development Canada, 2010).

In BC, the First Nations Emergency Services Society of BC (FNESS) provides participating First Nations communities with support related to emergency services; including fire protection services (e.g. fire training, education, prevention and support). FNESS programs are intended to develop professional capacity and to assist First Nations communities towards self-governance and also to reduce the number of injuries and fatalities while increasing safety in communities (First Nations Emergency Services Society of BC, 2013).

In BC, there are anecdotal reports that many First Nations communities contract out fire suppression services; however, very few of these communities are able to deliver fire safety education programs.

“Fire prevention awareness under the National First Nations Fire Protection Strategy aims at reducing fire-related deaths, injuries and damages. This work includes: installation of smoke alarms in community homes, dissemination of information about fire prevention and the importance of having and practicing a home escape plan. There is a need to have a more focused (aggressive) approach to enhancing fire safety education and home fire safety, in modernizing service standards, in strengthening fire safety inspections with follow-up on deficiencies, and in improving fire department capacity, training and recruitment. Implementing legislated building & fire codes which are not mandated on reserve, remains a focus as well. FNESS works with the Aboriginal Firefighters Association of Canada to further these strategies.” (Langlois, B., 2015).

*Programs that include active participation by children in learning fire responses are more effective e.g. “STOP, DROP and ROLL”*

## PART 4: BC CORONER SERVICE CASE REVIEW FINDINGS

The following is a summary of deaths of 34 children and youth who died as a result of residential fire related incidents between 2005 and 2014. This review is based on 22 separate residential fires which resulted in 45 fatalities. In thirteen of these fires there were multiple fatalities of children and/or children and adults, while nine fires involved the death of a single child or youth. In eighteen of these fires some children and adults were able to escape.

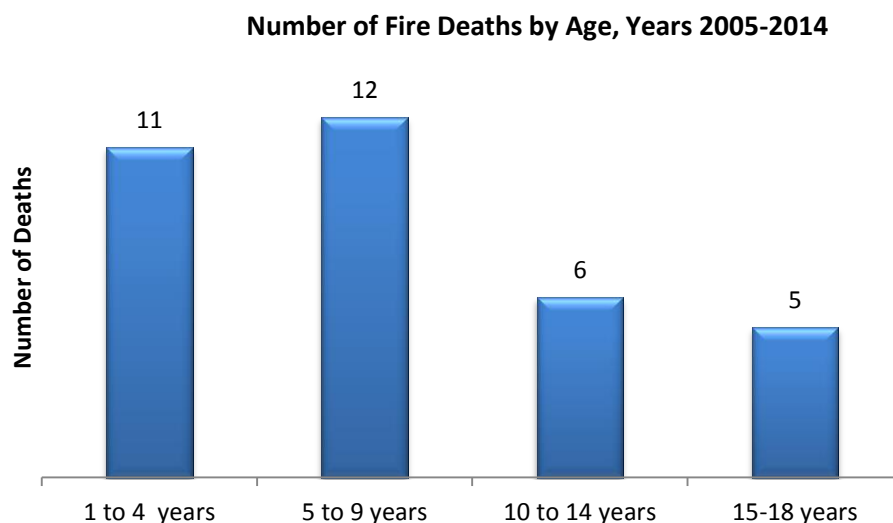
### A. THE YOUNG PERSON

For the 22 fire events, 34 of the 45 (76%) fatalities were children and youth under 19 years of age.

#### AGE

Of the 34 children and youth who died, 67 percent (n=23) were younger than 10 years old (see figure 2). Thirty-two percent were between the ages of 1 and 4 years old, and 35 percent were between 5 and 9 years old. No infants less than one year old died.

Figure 2



Source: BC Coroners Service

The most vulnerable age groups associated with fire deaths in this review were children under the age of 10 years old. Overall, fires were the third leading cause of deaths in children age 1-4 years (16.9%) and 10-14 years (5.3%) and the second leading cause of accidental deaths for children age 5-9 years old (20%)(see figure 3).

Figure 3

Leading Cause of Childhood Accidental Deaths in BC (2005-2014)

Age 1-4 years	Age 5-9 years	Age 10-14 years	Age 15-19 years
MVI: Traffic 29.2%	MVI: Traffic 46%	MVI: Traffic 55.8%	MVI: Traffic 61.2%
Drowning 21.5%	Fire 20%	Falls 10.5%	Poisoning 14.1%
Fire 16.9%		Fire 5.3%	Drowning 6.6%
			Falls 4.7%
			Fire 0.8%

Motor Vehicle Incident (MVI)

Poisoning includes Alcohol/Drug/Other

Source: BC Coroners Service

However, it should be noted that for children age 10 to 14 years, the majority of accidental deaths are related to other causes. This is also true for youth 15 to 18 years, where fire accounted for less than one percent of all accidental deaths.

These findings are similar to other research findings. For example, a review of 60 pediatric fire deaths in Ontario between 2001 and 2006 found that the highest incidence of fire deaths occurred in children younger than 6 years old (Chen, Bridgman-Acker, Edwards, and Lauwers, 2011). Similarly a report completed by the U.S. Fire Administration, based on data from 2010 to 2012, found that children under 9 years old accounted for 12 percent of civilian deaths in residential fires (n=2465).

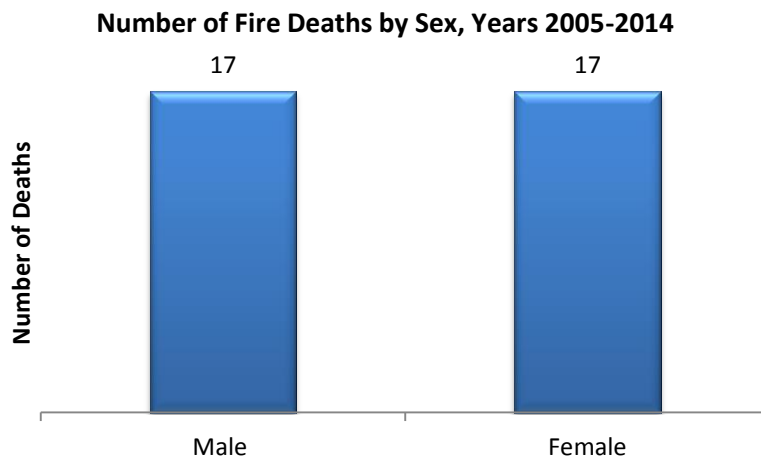
Research considering fire death by age suggests that younger children are at higher risk for death for a number of reasons such as being:

- More likely to play with fire (see section *The Circumstances of the Fire*);
- Developmentally unable to recognise fire danger and respond appropriately;
- Left unattended or unsupervised; and
- Dependent on others to escape (Warda, Tenenbein, and Moffatt, 1999, US Fire Administration, 2013).

## SEX

This review found that equal numbers of male children and female children died in these fire events (see figure 4).

Figure 4



Source: BC Coroners Service

As mentioned previously, a study of 60 pediatric deaths in Ontario occurring between 2001 and 2006 found that 48 percent of the deaths were females and 52 percent were males, which is similar to the findings of this review (Chen, Bridgman-Acker, Edwards and Lauwers, 2011). Research indicates that across all age groups, males are likelier to be injured or die in a residential fire than females; however, the differences appear to be small (Ahrens, 2014, US Fire Administration, 2014).

## B. POPULATION LEVEL ATTRIBUTES

The review included analysis of Aboriginal identity and involvement with child welfare. These groups are not mutually exclusive as some of the children and youth identified as both.

### **ABORIGINAL CHILDREN AND YOUTH**

Almost 30 percent (n=10) of the children and youth who died were identified as Aboriginal (see figure 5). Additionally, 4 adults also died in these fires.

Figure 5



Source: BC Coroners Service

Research into fire related deaths in Aboriginal communities suggests the rate of fire death across all ages is between 2 to 10 times higher than non-Aboriginal communities (Canadian Mortgage and Housing Corporation, 2007, Gilbert, Dawar, and Armour, 2006). Fire injuries were also found to be consistently higher in Aboriginal people as compared to the non-Aboriginal population (Canadian Mortgage and Housing Corporation, 2007). Research looking at BC data between 2006 and 2011 found a rate of 36.5 deaths per 1,000 fires in First Nations community residential structure fires compared to 15.1 deaths per 1,000 fires for the rest of BC (Garis, and Clare, 2012).

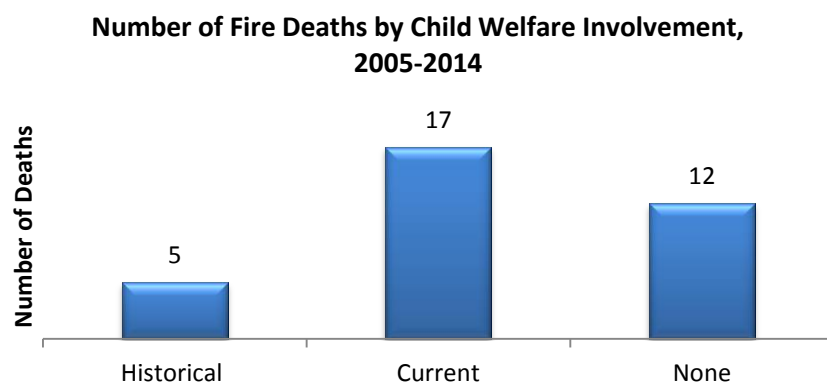
A 2006 study focused on fire related deaths among Aboriginal people in BC (1991 to 2001) found that cigarettes and heat sources (e.g. wood fires, electrical heating units) were common causes of residential fires, and that at least 35 percent of the homes either did not have a smoke alarm or the smoke alarm was not working (Gilbert et al, 2006). In the 2004 Canadian Housing Fire Statistics report, the main reasons for fire-related deaths were reported to be overcrowding and the inaccessibility to fire response services in remote locations (Canadian Mortgage and Housing Corporation, August 2004).

*Aboriginal people are at greater risk of fire related injury and death due to housing conditions*

#### **CHILD WELFARE**

More than 50% of the children and youth who died had involvement within 12 months of their deaths with the Ministry of Children and Families (MCFD). This includes one who died as a result of a fire in a foster home. In addition, 15 percent (n=5) of the children and youth had historical involvement with MCFD. Of the 10 Aboriginal children and youth who died, all had either historical (n=2) or current (n=8) involvement with MCFD at the time of their deaths (see figure 6).

Figure 6



Source: BC Coroners Service

The overrepresentation of children and youth involved with child welfare is consistent with research findings. For example, the Ontario study of 60 pediatric fire deaths between 2001 and 2006 reported that 32% of the children and youth who died had child welfare involvement (Chen, Bridgman-Acker, Edwards and Lauwers, 2011).

Much of the available research literature focused on the correlation between child welfare and injury finds that children and youth involved with child welfare are from homes that pose a higher risk of injury, including fire-related, compared to the general population. Factors noted include: residing in substandard housing, overcrowding, fire alarms that are not working, less supervision and likelier to be exposed to smoking (Chen, et al, 2011, U.S. Fire Administration 2015, Federal Emergency Management Agency, 1997).

## **C. THE FIRE-RELATED DEATH**

Fire death is mainly caused by either thermal burns or smoke inhalation, or a combination of these (DiGuseppi, et al (2000). Research indicates that smoke inhalation is the most common fire related cause of death (Cone, et al, 2008). Smoke inhalation from breathing in smoke that is comprised of harmful gases and small particles affects internal organs, primarily the lungs and airways in a body (U.S. Fire Administration, August 2014). Thermal burns are caused by contact with flames, hot surfaces and other sources of high heat (U.S. Fire Administration, August 2014). Smoke inhalation results in carbon monoxide binding with red blood cells (hemoglobin) at a much greater rate than oxygen which prevents the delivery of oxygen to the body tissues.

### **CAUSE OF DEATH**

Of 33 child and youth deaths where the cause is known:

- 57 percent (n=19) died of injuries caused by inhalation of smoke and burns;
- 33 percent (n=11) died of smoke inhalation; and
- 9 percent (n=3) died of injuries caused by burns

Approximately 75 percent of the children and youth (n=25) died of their injuries before medical intervention could be provided.

### **AUTOPSY**

Autopsies were completed in 80 percent of the deaths (n=27) to support identification and/or confirm that the injuries were fire related.

### **TOXICOLOGICAL ANALYSIS**

Toxicological analysis was completed for 82 percent of the deaths (n=28). The toxicological analysis provides the ratio of carboxyhaemoglobin (carbon monoxide bound to hemoglobin) concentration in a body. Ratios of carboxyhaemoglobin exceeding 40 percent are considered to be life threatening and levels higher than 60 percent are considered to be lethal. In this review, 4 of the children and youth had ratios of carboxyhaemoglobin between 31 percent and 60 percent, and 18 had ratios between 61 percent and 100 percent.

### CLASSIFICATION OF DEATH

The majority (85 percent) of the deaths (n=29) were classified as accidental. The remaining 5 deaths (15%) were classified as homicides<sup>6</sup> related to 2 separate fire incidents.

## PART 5: CIRCUMSTANCES OF THE FIRE

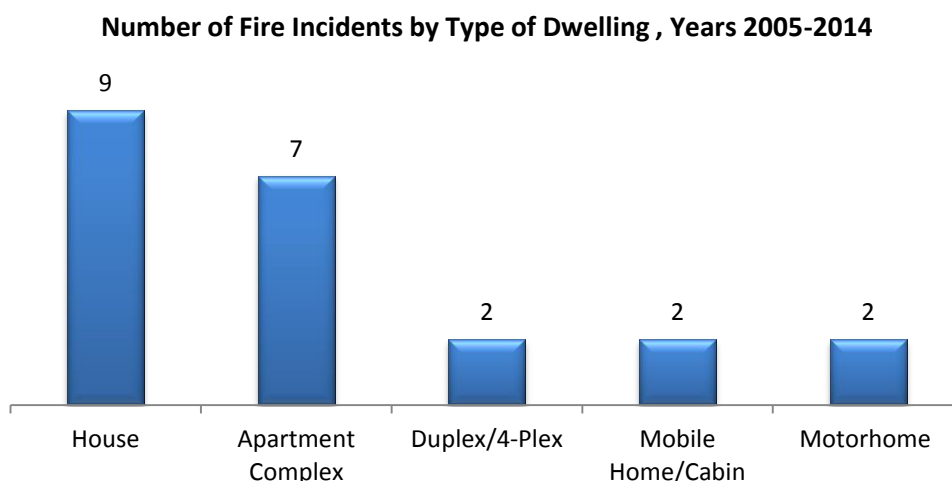
The following sections provide details about the circumstances for the 22 fires.

*Functional smoke alarms save lives and provide an early warning, allowing valuable time to safely evacuate or early fire suppression*

### TYPE OF DWELLING

Of the 22 fire events, more than 40 percent (n=9) occurred in a house (see figure 7). Fifty-five percent (n=12) of all residences were known to be rented. Research indicates that rental versus ownership of a home may be a risk factor although studies vary in whether this factor is statistically significant (Greene, 2011).

Figure 7



Source: BC Coroners Service

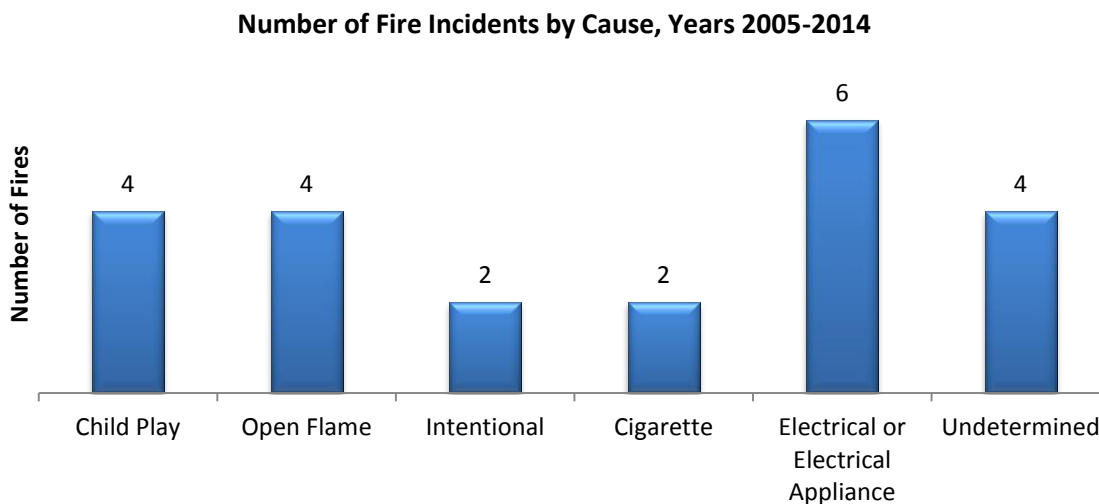
### CAUSE OF FIRE

The cause of the fires varied considerably across the fire incidents (see figure 8). Eighteen percent (n=4) of the fires were started by a child under the age of 10 years old, in a bedroom, using a lighter or matches. In each of these cases, at least one parent reported household tobacco use and in one case, the child was known to have a history of setting fires. For the remaining fires, four were due to an open flame (i.e. blow torch, barbeque, lantern, or candle),

<sup>6</sup> The BC Coroners Services defines the term homicide as: a death due to injury intentionally inflicted by action of another person. Homicide is a neutral term that does not imply fault or blame.

two were intentionally set, two fires were caused by a discarded cigarette, and six were related to electrical issues or misuse of an electrical appliance/fixture. In four fires the cause could not be determined.

Figure 8



Source: BC Coroners Service

The finding in this review, showing that 4 of the fire incidents were caused by child fire play are consistent with other research reporting that child fire play is a common cause of residential fires (Chen, et.al, 2011). Research completed by the National Fire Protection Association (NFPA), based on US data from 2007 to 2011, found that younger children are likeliest to set fires in a home and youth are likeliest to set fires outside. Out of just over 11,000 home fires, lighters were the source used in over half (52 percent) and the most common area involving fire play was a bedroom (39 percent) (Campbell, 2014, Istre, McCoy, Carlin, and McClain, 2002). A mattress or bedding was the item first ignited in 23% of these fires, while 10% began with magazines, newspapers, or writing paper and 9% began with rubbish, trash, or waste (NFPA 2015).

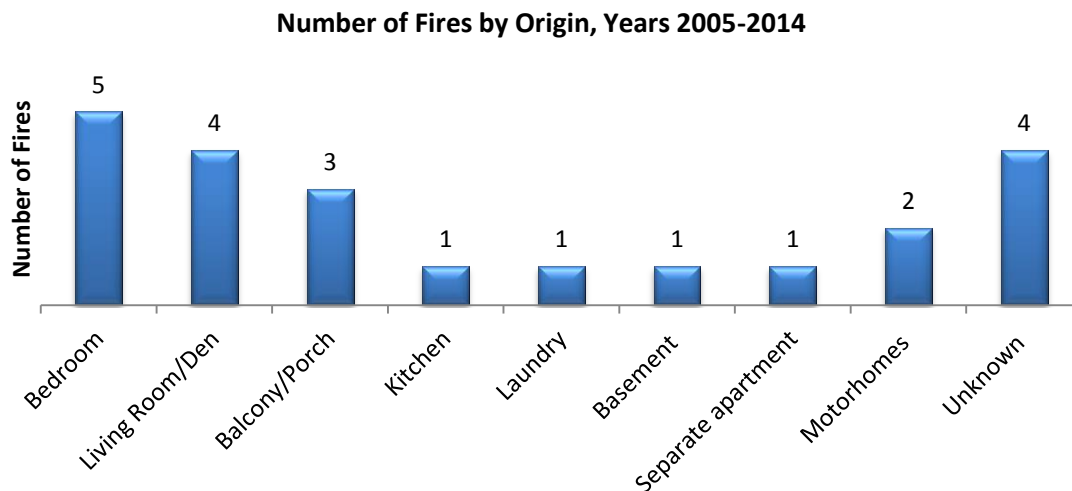
*'We didn't know our child had the knowledge or ability to ignite a lighter'*

Possible means of preventing fire play related injuries include educational programs aimed at children and parents to decrease access by children to flame sources, implementation of childproof lighters and matches, and labeling of matches. Programs to prevent fire play related injuries must be oriented towards the preschool age population and their families (Istre, et al., 2002).

### ORIGIN OF THE FIRE

In 18 of the fire events, the origin of fire was known (see figure 9). Half of these fires originated in either a living room or bedroom area.

Figure 9



Source: BC Coroners Service

These findings are consistent with U.S. and Canadian research which indicates that fires originating in bedrooms and living rooms are associated with higher the fire fatalities (U.S. Fire Administration, 2013, U.S. Fire Administration, 2014, Chen, et.al, 2011).

Research suggests that in some cases, a single smoke alarm may not be heard in some parts of the home compared to interconnected smoke alarms that are placed throughout the home and increase the opportunities for parents/caregivers (or the children or youth) to wake and respond to a fire anywhere in the house (Ahrens, 2014). Ideally, smoke alarms should be installed inside all sleep areas. Smoke alarm provisions in the *BC Fire Code* (May 1, 2010) now require smoke alarms to be installed outside sleeping areas in single family, semi-detached and town homes that are owned or rentals.

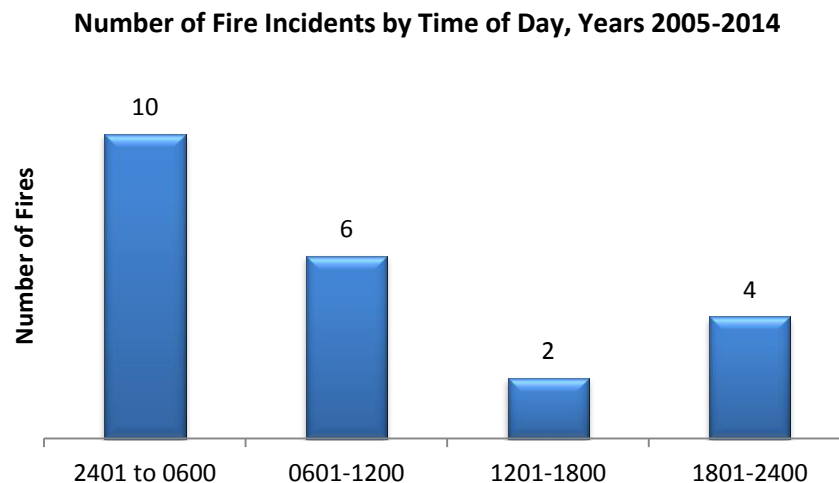
In this review, three of the fires originated outside of the home on a balcony or porch. Research of multi-residential building fires suggests that fires starting on the exterior of the building are less likely to activate a smoke alarm, and are more likely to require visual detection (Garis, et.al, 2013). Research indicates that sprinklers on balconies, fire-resistant exterior cladding and additional fire separation in roof areas can mitigate the damage of exterior fires (Garis, et.al, 2013).

*The BC Fire Code (2010) requires that smoke alarms be installed outside sleeping areas in single family, semi-detached and town homes that are owned or rentals.*

### TIME OF DAY

Almost half of the fires (45%, n=10) occurred between the hours of midnight and 6:00 a.m., with the least number of fires (9%, n=2) occurring between noon and 6:00 p.m. (see figure 10). However, for the fires that began between 6:00 a.m. and noon, 3 were associated with child fire play.

Figure 10



Source: BC Coroners Service

These findings are consistent with findings of the U.S. Fire Administration which found that most fatal fires happened late at night or early morning, when most people were sleeping (U.S. Fire Administration, 2014). Similarly a review of pediatric deaths in Ontario (2001- 2006) found that late night fires were more likely due to electrical failure or unattended candles whereas fires during the day were often caused by fire play or stove top fires (Chen, et.al, 2011).

### ESCAPE ATTEMPTS

The majority of the children and youth who died (62 percent, n=21) were in a different room from where the fire started, while 26 percent (n=9) were in the same room where the fire started. It was unknown where 12 percent (n=4) of the children and youth were in relation to the fire when it started.

Evidence at the fire scene indicated that 41 percent (n=14) of the children and youth attempted to escape the fire, while 44 percent (n=15) were noted to have made no escape attempt. In 15 percent of the deaths (n=5) it was unknown if escape was attempted or not. In 14 percent of the fires (n=3), children had been left unattended in the home for a period of time.

Young children may not have the developmental capacity to respond appropriately in a fire. Research indicates that young children are reliant on the actions of their parent or guardian to remove them from the fire or on the cues of others to take action in a fire. Developmental awareness about fire safety makes escaping independently difficult for young children (Harpur, Boyce, and McConnell, 2013).

In addition, research indicates that there are a number of factors that can prevent escape attempts. The US Fire Administration suggests that sometimes people may try to extinguish the

fire thereby delaying escape. In the deaths reviewed, some of the children, youth (or adults) were noted to have tried to put the fire out.

Research also indicates that many people try escaping through the area where the fire is and that by doing so, the person is exposed to heat, smoke and toxic gases that may cause unconsciousness. Other factors that may prevent escape include: being unfamiliar with exits, excessive distance to the nearest clear exit or choice of an inappropriate exit route (U.S. Fire Administration, 2014).

A number of fire protection service agencies recommend that an escape plan is pre-prepared and practiced. Multiple escape options and procedures in place to assist those who require additional assistance (e.g. children with disabilities, infants) can increase the chances of getting out safely (U.S. Fire Administration, 2014).

## **FIRE PREVENTION DEVICES**

The literature is clear that the use of smoke alarms to detect smoke (Warmack, Wise, and Wolf, March 2012) and sprinkler systems are effective in reducing fire injuries and fatalities (Garis, and Clare, 2013).

### **SMOKE ALARMS**

Of the 22 fires reviewed, 8 residences were known to have a functioning smoke alarm, whereas six residences did not have a smoke alarm present, and in five residences the presence of a smoke alarm could not be determined (see table 2). In several of the fires, the smoke alarm had been previously intentionally deactivated because of false alarms or for other reasons such as the battery being used for another purpose.

Table 2 - Presence of Functional Smoke Alarm

Smoke Alarm Present and Functional	No Smoke Alarm or Smoke Alarm not Working	Unable to Determine if a Smoke Alarm was Present
8	9	5

Research indicates there are fewer fatalities in residences with a functioning smoke alarm in comparison to residences with no functioning smoke alarm (U.S. Fire Administration, July 2013) and (Ahrens, 2014). Research based residential fire incidents in BC found that the rate of fatalities in fires without a functioning smoke alarm was 15.2 per 1,000 fires in 2007 compared to 8.9 per 1,000 fires in 2014 where a smoke alarm was present and working (Garis, et.al, 2015).

Literature also indicates that routine maintenance is needed to ensure a smoke alarm is functioning properly and that these devices are replaced when they have reached their life expectancy (Garis, et.al, 2012).

There are a variety of reasons why a smoke alarm would be non-functioning. Reasons include people disconnecting them, or alarms having missing or dead batteries (Ahrens, 2014). As well, depending on their sensitivity, alarms may be viewed as a nuisance due to false alarms produced when someone is cooking or when there is a buildup of dust in the air (Warmack, Wise, and Wolf, March 2012). The life of a smoke alarm will vary depending on the type of alarm and it is possible that people may not be aware of how often the batteries need changing or that the alarm needs replacing.

Concerns about the effectiveness of smoke alarms to wake children have been raised in some public forums. It has been suggested that a child's development may compromise their ability to be roused from sleep and once awake, respond to a fire alarm (Bruck, Reid, Kouzma, and Ball, 2004). It is also important to note that depending on the circumstances, a child or youth may rely on the parent to awake from an alarm and respond.

Research suggests that targeting high risk residences and having firefighters offer home visitation and smoke alarm installation is an effective means of educating people and ensuring these homes are equipped with functioning fire alarms (Garis, et.al, 2012).

As mentioned, in addition to education and smoke alarm installation programs, there is also legislation across various jurisdictions requiring smoke alarms be installed in residential settings. The *BC Fire Code* (2010) requires that smoke alarms be installed outside sleeping areas in single family, semi-detached and town homes that are owned or rentals. Enforcement to ensure compliance is difficult as there is limited ability for fire protection service representatives to enter private residences<sup>7</sup>.

It should be noted that smoke alarms are effective in preventing deaths and injuries from residential fires due to all causes other than arson or fire play (Istre, et al., 2002). The lack of efficacy of smoke alarms with fire play related fires may be due to a number of factors including the location of the fire, the rapidity of the spread, the placement of smoke alarms, the behaviour of children after the fire starts, and the lack of supervision associated with fire play (Istre, et al., 2002).

### **SPRINKLER SYSTEMS**

None of the residences where fire fatalities occurred had a sprinkler system installed.

Automatic fire sprinklers reduce fire injuries, deaths, property damage and exposure to environmental toxins emitted during fires.

BC Office of the Fire Commissioner data (October 2006- October 2011) found that of 9,481 residential fires, 91.3 percent of the fires happened in residential buildings without sprinklers. Across all the residential fires, the death rates for residences without sprinklers was 15.9 deaths per 1,000 fires (72.9 injuries) compared to 1.2 deaths per 1,000 fires with sprinklers (47.7 injuries) (Garis, and Clare, 2013).

Automatic sprinklers are an important fire prevention device for all homes, new and old. Homes built on small lots and in close proximity increases the risk of a fire's spread from one house to another. As well, "combustible furnishing and new home materials have accelerated the time from a fully developed fire to a flashover to about 2-5 minutes" (Banfield et al, 2015). Flashover refers to an event where all combustible materials in an enclosed area reach their ignition temperatures at the same time due to rapid heat buildup.

The 2013 Home Sprinkler Cost Assessment report from Fire Protection Research Foundation compared installation costs in a number of BC municipalities. The report indicated that the average cost of sprinkler installation is \$1.16 per sprinklered square foot, or approximately \$2900.00 for an average single-family dwelling. The lowest installation costs were found in Pitt

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<sup>7</sup> Correspondence with the fire commissioner's office re: email from Stephen Watt-Codes and Standards Coordinator.

Meadows, BC which reported under a dollar per square foot or \$0.94 precisely. Although, home owners fund the installation, savings are achieved through lower municipal fire protection costs.

Home fire sprinklers are heat activated and are designed so that only the sprinkler closest to the fire will open. Once activated, it generally releases less than 80 litres of water per minute, whereas a firefighter's hose discharges more than 800 liters per minute (Banfield, Gomez, Redelmeier and Jeschke, 2015).

Evidence also indicates that home fire sprinklers can control and may even extinguish a fire before fire crews arrive on scene. Firefighters are usually dispatched four minutes after a fire begins with hoses working within ten minutes. By the time fire hoses are deployed, the temperature of the room involved is so high that flashover has either already occurred or will occur. Sprinklers may prevent flashover (Garis, not dated).

The US based National Fire Protection Association (NFPA) has found that the risk of dying in a house fire is decreased by 80% when sprinklers are present.

Since the implementation of building by-laws in the 1990's requiring sprinklers in new dwellings, the City of Vancouver has had no directly related deaths in occupancies where sprinklers have been activated.

Fire injury treatment costs are substantial especially as they pertain to children. Child burn injuries may require much greater medical care and treatment (and costs) as a result of life long treatments. Recent burn injury research has shown that where sprinklers are present and they are activated, civilian fire injury medical costs are reduced by 53 percent (NFPA 2014).

NFPA and the US Fire Administration research indicates that if homes were equipped with fire sprinkler systems it would result in:

- Civilian fire death cost reductions of \$10.4 billion/annually
- Civilian fire injury total cost reduction of \$1.5 billion/annually.

The current NFPA International Residential Building Code requires that fire sprinklers be installed in all new one and two family dwellings and multi-family dwellings.

### **FIRE EXTINGUISHERS**

Where the existence of a fire extinguisher in the home was noted (n=4), the location of the fire extinguisher or whether there were any attempts to use it was not identified.

### **REGIONS<sup>8</sup>**

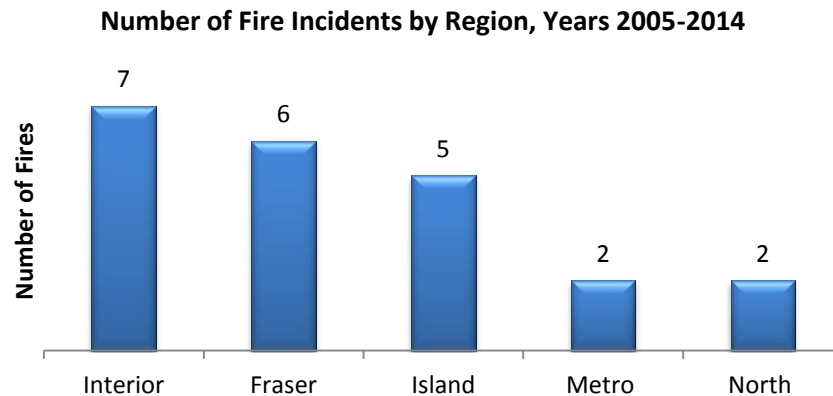
Of the 22 fires included in this review, seven were located in the Interior region, six were located in the Fraser region and five were in the Island region. There were two fires located in each of the Metro and the North regions (see figure 11).

The highest number of deaths (32%, n=11) happened in 7 incidents located in the Interior region. There were an equal number of deaths (7 per region) in Fraser and Island region, whereas 5 children and youth died in Metro region and 4 children's deaths occurred in the Northern region.

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<sup>8</sup> Based on the BC Coroners Service regions as outlined in Appendix 1

Figure 11



Source: BC Coroners Service

Based on community size, approximately one third ( $n=8$ ) of the residences were located in rural areas and two thirds ( $n=14$ ) were located in urban areas. Because of the small number of events, findings should be interpreted with caution.

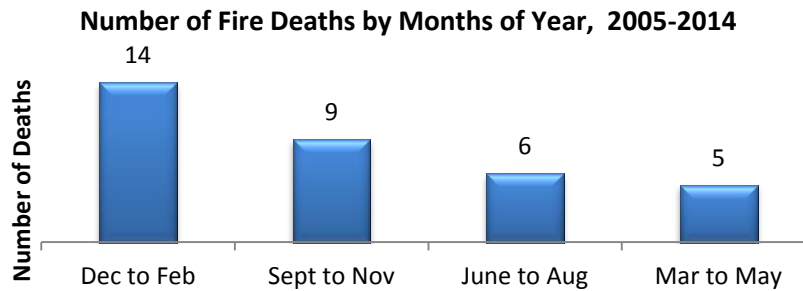
Research indicates that because rural areas are less populated, there is less chance that a fire will be noticed by a passerby (Veerasathpurush, Peek-Asa, Jingzhen, and Zwerling, 2007). In addition, rural homes tend to be farther away from emergency services, making response times longer (Veerasathpurush, Peek-Asa, Jingzhen, and Zwerling, 2007) and Garis, and Clare, 2012).

Research suggests that volunteer fire protection services generally serve rural areas in comparison to career fire protection services that generally provide services to urban areas (Garis, and Clare, 2012). Differences between rural and urban fire protection services may also include: training, response times, equipment availability, and personnel capacity that may impact the fire protection services provided to communities (Fire Liaison Group, 2009).

#### **TIME OF YEAR**

The highest number of deaths (41 percent,  $n=14$ ), occurred in 10 fire incidents in the winter between December and February and in 5 fire incidents between September and November (26%,  $n=9$ ) (see figure 12). In the summer, between June and August, there were 18 percent ( $n=6$ ) deaths that occurred in 4 fire incidents and in spring, between March and May, there were 15 percent ( $n=5$ ) deaths that occurred in two fire incidents (see figure 12).

Figure 12



Source: BC Coroners Service

The findings in this review are similar to other research findings that indicate residential fatal fires happen more frequently in colder months and are lowest in the warmer months (U.S. Fire Administration, August 2014).

### **SPECIALIZED INVESTIGATIONS**

When a fire occurs, a number of agencies may complete an investigation as part of their respective mandate. In all of the fire deaths, the BC Coroners Service, police, fire department or Office of the Fire Commissioner completed investigations. Depending on the circumstances, other agencies may conduct an investigation (e.g. First Nations communities, insurance companies, gas and electrical inspectors).

In three of the fires in this review, the coroner's report noted that actions were taken by other agencies following specialized investigations. Actions included: installation of fire alarms, providing exterior ladders for homes, an education program to address awareness and safety and fire safety improvements for recreational vehicles. Additionally, one fire resulted in a criminal conviction for homicide.

Apart from the actions noted in the coroner's reports, some agencies may have taken steps to mitigate the risk of similar fires in the future.

## PART 6: RECOMMENDATIONS

Research and this review suggests that the majority of residential fire related deaths could be prevented through appropriate disposal of smoking materials, keeping lighters and matches out of reach of young children, ensuring that working smoke alarms are in place, and that homes are protected by a residential sprinkler system.

The review panel identified issues with a lack of available data about fire events in general and differences in data collection and reporting requirements. As well, this review found a need for additional provincial training related to fire awareness, prevention and safety.

The panel identified three key activities to reduce residential fire deaths:

- Develop provincially standardized fire safety education materials targeted to vulnerable families and assess the effectiveness of these;
- Improve use and access to smoke alarms specifically targeting vulnerable populations in partnership with family serving programs and agencies; and
- Improve fire data collection and sharing of information about fire events and outcomes.

The recommendations arising from the death review panel were developed in a manner that was:

- Collaborative;
- Attributable to the deaths being reviewed;
- Focused on identifying opportunities to improve public safety and prevent future deaths;
- Targeted to specific parties; and
- Realistic, reasonably implementable and measurable.

## EDUCATION AND AWARENESS

### **Recommendation 1: Fire Safety Education and awareness**

By December 2017, the Fire Commissioner in collaboration with the Fire Chief's Association of BC (FCABC) and the Fire Prevention Officers Association of BC (FPOBC) to adopt, develop and utilize standardized provincial fire prevention/ safety training materials, including the Juvenile Fire Setter Program.

### **Recommendation 2: Fire Safety Prevention**

By September 2016, the Fire Commissioner to work to expand partnerships with provincial programs and community agencies working with vulnerable families to improve access to and use of smoke alarms.

The Ministry of Natural Gas Development and Responsible for Housing, Office of Housing and Construction Standards to investigate the evidence and feasibility of mandating sprinkler system installation in new homes in the BC Building Code.

## INFORMATION SHARING

### **Recommendation 3: Data Quality and Information Sharing**

By December 2017, the Fire Commissioner in collaboration with the Fire Chiefs Association of BC to identify common datasets (relevant to injuries/fatalities) for collection and incorporation into the fire reporting requirements and annual statistical reporting.

The Fire Commissioner to collaborate with appropriate national organizations to ensure consistency in data collection with the National Fire Information Database.

The BC Coroners Service share coroners' reports of fire-related deaths with police and fire officials in order to improve policy and best practices between the agencies.

## PART 9: GLOSSARY AND REFERENCES

### GLOSSARY

**Aboriginal:** Reference used to encompass First Nations (status and non-status), Metis and Inuit people in Canada.

**Aggregate:** Presentation of individual findings as a collective sum.

**First Nations:** Status and non-status “Indian” peoples in Canada. An individual recognized by the federal government as being registered under the Indian Act is referred to as a Registered Indian (commonly referred to as a Status Indian).

**Vulnerable:** populations at greater than average risk of injury or death by virtue of their marginalized socio-cultural status, limited access to economic resources or personal characteristics such as age.

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## APPENDIX 1: BC CORONERS SERVICE REGIONS

