The Epidemiology of Residential Fires Among Children and Youth in Canada

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BC INJURY research and prevention unit

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Executive Summary

The purpose of this report is to detail the epidemiology and burden of residential fire injuries and deaths among Canadian children and youth, aged 0 to 19 years for the ten-year period, 2005-2015. For the first time, comprehensive fire data from across Canada is available in the National Firefighters Information Database. Using this novel dataset, this report explores the impact of residential fires on children and youth in five provinces from 2005 to 2015[c]. Socioeconomic and geographic vulnerabilities are described within the context of a population and public health framework.

Between 2005 and 2014, there were a total of 148,513 fire incidents in Canada, resulting in 11,448 casualties. Residential fire incidence varied between 2005 and 2014; however, the casualty rate remained steady, with 700 to 800 casualties per 10,000 fires between 2009 and 2015. Across all provinces, children aged 0 to 4 years, and youth aged 15 to 19 years, suffered the highest rates of injuries and deaths. The top causes of injuries and death among children and youth were smoke inhalation and burns. Children aged 0 to 4 years and 15 to 19 years suffered the highest incidence of causalities by smoke inhalation; however, a positive relationship was found between burn casualty rate and increasing child age. Additionally, males were more likely to suffer an injury or death among all children and youth age categories, with the exception of females aged 5 to 9 years.

Patterns of child and youth casualties were not affected by the construction of the home, where the fire started, or how far the fire spread. Working smoke alarms were associated with lower rates of death and higher rates of injury relative to incidents where no smoke alarm was present or working in the home. Additionally, sprinklers were associated with lower death rates across all age categories. These findings suggest that although smoke alarms prevent deaths, they may provide little benefit for the prevention of fire-related injuries among children and youth, while increasing the number of homes with sprinklers may substantially reduce child and youth casualties.

Socioeconomic factors modeled using a Poisson regression revealed a statistically significant relationship between measures of low socioeconomic status and residential fire casualties. Among children and youth, the casualty rate was significantly associated with the percentage of lone-parent dwellings in the region; for each percent increase in single-parent dwellings in the region, the casualty rate due to residential fires likewise increased by 7.4%.

Results of this study indicate that interventions to protect Canadian children and youth from injury and death in residential fires should emphasize babies, preschoolers and teenagers; lone-parent families; and improving safety features in the home such as fire alarms and sprinkler systems. Further work to improve data collection and validation practices will enable more sophisticated modeling of risk and protective factors within the Canadian context.

[c] BC, AB, MB, and NB (CAF) provided all 11 years (2005 to 2015), ON provided data for 10 years (2005 to 2014), and SK provided data for 4 years (2012 to 2015).

Comprehensive evidence of burden, risk and vulnerability is needed to appropriately guide policy decisions at local, regional and provincial levels. This report permits greater precision in prevention efforts moving forward – helping to guide stakeholders such as local fire departments, injury prevention practitioners and policy makers in decisions to improve the prevention of fires and fire-related injury among children and youth.

The following recommendations are proposed on the basis of the study findings:

- Improve data quality to facilitate more sophisticated modeling of risk and protective factors:
    - Standardize data entry across provinces to allow for interprovincial comparisons across a range of variables;
    - Standardize data collection forms and protocols, and provide support and training for these resources through an online portal that can be accessed by members;
    - Create a variable that allows for distinguishing between paid and volunteer firefighters who respond to each fire incident;
    - Collect information to describe persons who were present in the building at the time of the fire but did not suffer any casualty;
    - Improve the accuracy of documentation of demographic variables, such as age and sex, of persons who suffered any casualty;
    - Improve the documentation of variables related to smoke alarms and sprinkler systems in residential fires to support a case for expanding programs and implementing policies that put working smoke alarms and sprinkler systems in more homes;
    - Track progress towards a more accurate and complete database, and create a system for resolving data collection and reporting issues and queries.

- Focus more preventative interventions on low-SES neighbourhoods:
    - Provide additional education and supports to lone-parent families, potentially through partnerships with local community groups, NGOs, or the Ministry of Child and Family Development.

- Foster local and regional partnerships between firefighting services and child and family services to improve coordination, delivery and impact of preventative programming.

Introduction

Residential fires pose a significant risk of injury morbidity and mortality among children and youth in Canada. Between 2006/07 and 2012/13, nearly 1,200 Canadian children were hospitalized due to an injury related to a fire or flames in the home.[d] Residential fires are the fifth leading cause of unintended child death in British Columbia (BC).[1]

Historically, up-to-date Canadian fire statistics have been difficult to obtain; the most recent report, published in 2011, describes fire losses from 2007.[2] The National Fire Information Database (NFID) is a novel dataset that unifies fire data collected across the country, permitting the epidemiology of child and youth residential fire injuries to be more fully described at a national level for the first time. This report details the burden and epidemiology of residential fire-related injuries among Canadian children and youth using the information available in the NFID.

Known risk factors for residential fire injury include, but are not limited to: substandard housing, lack of working smoke alarms and smoking paraphernalia in the home.[3] With nearly one-in-five Canadian children living in poverty,[4] identifying patterns and the underlying risk factors is particularly important to understand the interplay between the social determinants of health and the burden of residential fire injury among children and youth.

This study approaches the epidemiology of residential fire injury burden within a population and public health framework. A population health perspective seeks to understand why health disparities between different segments of the population exist and to then address the underlying causes in the social, political, economic and built environments. The public health perspective aims to solve health problems by recognizing the relationships between the person, the disease (injury) and the environment in which that disease occurs and is managed. These two approaches, when enmeshed in a single framework, allow for the epidemiology of the residential fire injury burden among children and youth to be described within Canada's social, economic and geographical landscape.

Comprehensive evidence of burden, risk and vulnerability is needed to appropriately guide policy decisions at local, regional and provincial levels. This report allows for greater precision in prevention efforts moving forward – helping to guide stakeholders such as local fire departments, injury prevention practitioners and policy makers in decisions to improve the prevention of fires and fire-related injury among children and youth. While such efforts will likely combine expertise within the three pillars of injury prevention (education, engineering and enforcement),[5] this epidemiological report positions the Canadian Association of Fire Chiefs as leaders in child and youth fire injury prevention, and highlights the utility of the NFID in furthering evidence-informed prevention initiatives, as well as facilitating interdisciplinary collaboration across domains.

[d] Discharge Abstract Database (DAD), Canadian MIS Database (CMDB), Canadian Institute for Health Information. Retrieved from iDOT© *Injury-Related Hospitalization Tool*, The Canadian Atlas of Child & Youth Injury Prevention: http://injuryevidence.ca.

Purpose

The purpose of this comprehensive report is to describe the burden of residential fires and residential fire-related injuries directly affecting children and youth in Canada for the ten-year period, 2005-2015. This report provides stakeholders with a comprehensive evidence base in order to help guide their efforts to develop, implement and evaluate interventions aimed at reducing child injury morbidity and mortality caused by residential fires.

The specific objectives of this report are: (1) to determine the extent to which Canadian children and youth, 0 to 19 years of age, are affected by residential fires across 5 provinces: British Columbia (BC), Alberta (AB), Saskatchewan (SK), Manitoba (MB), and Ontario (ON); (2) to determine whether child and youth risk and vulnerability are affected by proximal factors, such as the features of the residential building or of the fire incident itself; and 3) to determine what social, economic or geographical components of vulnerability among children and youth affect the risk of injury due to residential fires.

Background

PEER-REVIEWED LITERATURE

To date, there is no published peer-reviewed literature detailing the burden of residential fires causing injury to children and youth in BC. However, the research is clear that residential fires disproportionately affect those of low socioeconomic status (SES). Studies conducted in the United Kingdom (UK) and United States (US) have consistently shown that stepwise increases in residential fire risk correspond to diminishing levels of SES.[6,7] Although sparse, reports from BC describe similar trends among the adult population.

A 2009 study mapped injuries and deaths from fire and burns of persons over 18-years of age onto SES throughout BC. The authors used 2001 Census data in combination with injury data from the provincial trauma registry and coroner case files. They found that throughout BC, and particularly in urban neighbourhoods, SES was strongly correlated with fire-related injuries such as burns and inhalation. Although this study was not limited to injuries and deaths caused by residential fires, and included work-related as well as intentional causes, the evidence suggests that, as in other regions in Canada, SES is likely related to residential fire injury risk in BC.[8]

Even more recently, temporal and geographical clustering of residential fires was mapped onto SES in the city of Surrey, BC.[9] The study authors demonstrated that high-risk areas of the city overlaid low-SES areas of the city. Using Routine Activity Theory and Crime Pattern Theory to explain the results, the authors concluded that residential fires are non-random and cluster in time and space, due to the spatio-temporal relationship between the environment and human behaviour.[9] Although the analysis was limited to a single urban area in BC, the study provides important insight into the pattern of residential fires as a result of meaningful interplay between geographic, economic and social environments.

The international research is equally clear that children from low income families residing in temporary, rental or high density housing are more at risk of residential fire injury.[10] Older

buildings often have faulty or insufficient electrical wiring, and families living in poverty may rely on space heaters.[11] Smoking and alcohol use within the household also put children at risk. Young children in particular are more likely to engage in risky fire play at home if the materials are readily available, or are unable to escape a fire if the adult caregiver is sleeping or intoxicated.[12,13] One of the few studies exploring social and environmental factors in pediatric fire-related fatalities in Canada found that children in families involved with Children's Aid Society (CAS) were 32 times more likely to die in a residential fire than children without CAS involvement.[3] Child and youth involvement in residential fires is clearly nuanced by social factors at the family, community and societal levels.

Still lacking is a comprehensive view of children and youth in Canada injured or killed in a residential fire, particularly from a health epidemiology perspective that considers the interplay between social determinants of health affecting low-income families and the burden of residential fire injury.

Methods

DATA SOURCE

The National Firefighters Information Database (NFID) is a novel database containing fire incidents and victims reported by Fire Commissioners and Fire Marshal Office from seven different jurisdictions from across Canada – British Columbia (BC), Alberta (AB), Saskatchewan (SK), Manitoba (MB), Ontario (ON), New Brunswick (NB) and the Canadian Armed Forces (CAF). The database includes 11 years of fire information, from 2005 to 2015; however, not all jurisdictions provided data for all years. BC, AB, MB, NB and CAF provided all 11 years, ON provided data for 10 years, 2005 to 2014; and SK provided data for 4 years, 2012 to 2015.

The NFID also includes social domain data from Statistics Canada at the census subdivision (CSD) and census metropolitan (CMA)/census agglomeration (CA) levels. Social domain data was provided from both the 2006 Census and the 2011 National Household Survey (NHS).

The NFID was separated into two main files: the incident file and the victim file. The incident file represents a single fire incident attended by a fire service within the reporting jurisdiction between 2005 and 2015. The victim file represents either a single death or a single person injured as a result of the fire incident. A single fire incident, therefore, may have multiple injuries and/or deaths. The incident file was then merged with the victim file through the common identifying variable present in the two data files.

STUDY POPULATION

All individuals who suffered an injury or death in a residential fire within the Canadian provinces of BC, AB, MB, and ON, were included in the study. New Brunswick did not provide residential information, and CAF did not provide injury or death information, hence both were excluded from the study.

INCLUSION CRITERIA

A subset of the NFID was created to select for residential fire incidents and fire-related injuries and deaths. Any incident categorized as residential in the *Major Occupancy* variable and the *Property Classification* variable was selected, to ensure that all cases of residential fires were captured. These variables were combined to create a single *Residential Variable* for the purposes of analysis.[e]

Major Occupancy inclusion: unspecified; row, garden, town housing; condominium, apartment, tenement; single detached; duplex, 3-plex, 4-plex, semi-detached; mobile home/trailer park; residential with business/mercantile, up to 3 stories; hotel, motel, lodge, hostel, boarding house, dormitory; educational institution (residential), camp site/RV park.

Property Classification inclusion: one and two-family dwellings; apartment, tenement, flat, townhouse, condominium; rooming, boarding, lodging house, hostel; hotel, inn, lodge; motor hotel, motel; dormitory; mobile home, mobile accommodation, trailer; camp/retreat – seasonal use; miscellaneous – residential.

OUTCOME VARIABLES

The primary outcome of interest included fire incidents, fire-related injuries, deaths and casualties. Injuries and deaths were re-coded from the *Nature of Casualty* variable. Death was defined as death, while injury was defined as follows: minor injury (less than 1 day in hospital or time off work); light injury (hospitalized 1-2 days and/or time off work 1-15 days); serious injury (hospitalized 3+ days and/or time off work 16+ days); and injury, seriousness unknown.

For the purposes of this report, *Casualties* are defined as a combination of injuries and deaths.

ANALYSIS

Descriptive statistics were conducted by province, age-group, sex, residential construction type, igniting object, origin of fire, presence of working smoke alarms and sprinklers.

The rate per 10,000 fires was calculated using the number of child and youth injuries, deaths, or casualties over the residential fire incidents in a specific category multiplied by 10,000. For age-specific rates, the total number of residential fire incidents (148,513) was used as the denominator, as age-group information was not available in the incident file.

[e] The province of New Brunswick is excluded from this analysis as residential information was not provided to the NFID.

Results and Discussion

CHILDREN AND YOUTH IN CANADA

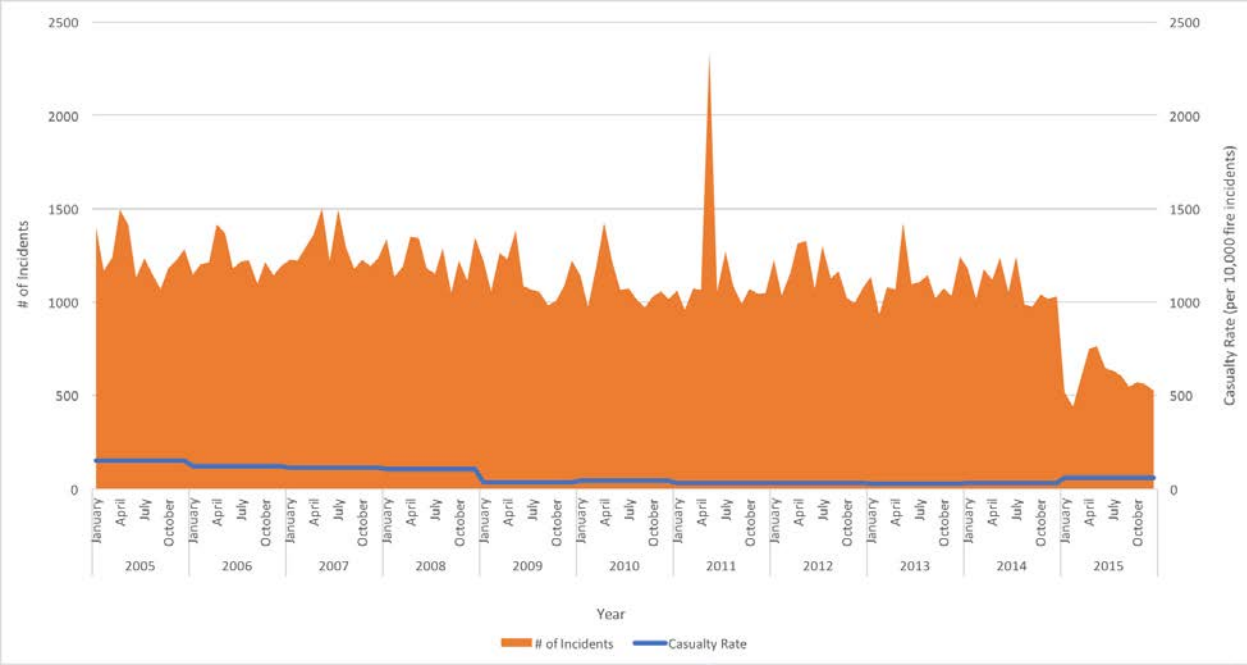
Results

Between 2005 and 2015, there were a total of 148,513 fire incidents in Canada, resulting in a total of 11,448 casualties. Of these, 1,057 casualties represented children and youth. Figure 1 illustrates the number of fires and the casualty rate per 10,000 fires each year for the entire study period. The number of residential fire incidents varied from month to month, and year to year between 2005 and 2015. The noticeable spike in the number of fire incidents in 2011 is attributable to a single wild fire event in one province (Alberta), that affected a significant number of residential buildings, while the decreased number of fires in 2015 results from missing data from one province (Ontario). In general, between 2005 and 2014, the number of fires in Canada ranged between some 1,500 in 2017 and approximately 1,000 in the years 2009-2014.

Nearly half of the residential fire incidents reported in the NFID occurred in Ontario.

In general, the number of residential fires in Canada was approximately 1,250 in the years 2005 to 2008, and approximately 1,100 in the years 2009 to 2014. The notable spike in the number of fire incidents in 2011 is attributable to a single wild fire in a single province (Slake Lake, Alberta) that affected a significant number of residential buildings, while the decreased number of residential fires in 2015 results from missing data from one province (Ontario) (Figure 1).

FIGURE 1: NUMBER OF FIRE INCIDENTS AND CASUALTY RATE BY YEAR, CANADA, 2005 TO 2015



Note: Ontario did not provide incident data for 2015.

Of the 6,772 casualty cases that had age information recorded in the NFID, 15.6% represented children and youth (N= 1,056). Children and youth, 0 to 19 years, suffered an injury rate of 60.5 per 10,000 fires and a death rate of 10.6 per 10,000 fires – the third highest relative to the other age categories (Appendix B). Table 1 indicates that the rate of injuries exceeds the rate of deaths in all age categories among children and youth. Among this population, the youngest children (0 to 4 years) and older teens (15 to 19 years) had the highest number of injuries and deaths.

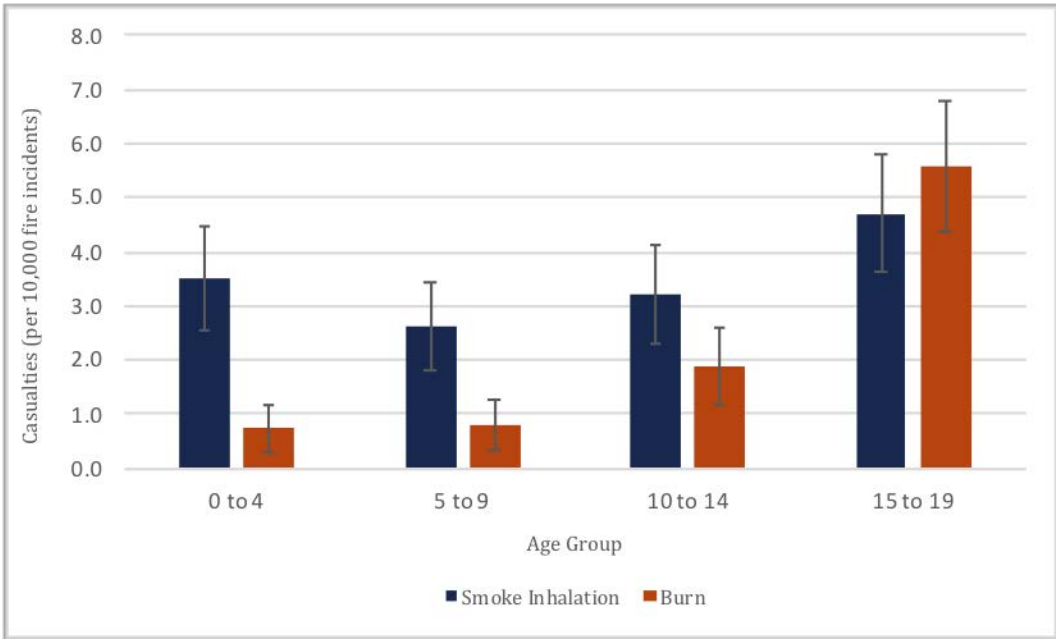
TABLE 1: RATES OF FIRE RELATED INJURIES AND DEATHS BY PROVINCE AND AGE GROUP, CHILDREN AND YOUTH, 2005 TO 2015

Province	Outcome	Rate of Injury and Death			
		0 to 4 years	5 to 9 years	10 to 14 years	15 to 19 years
All	**Injury**	**20.4**	**12.5**	**8.6**	**19.1**
		(18.1 to 22.7)	(10.7 to 14.3)	(7.1 to 10.1)	(16.9 to 21.3)
	Death	**3.6**	**2**	**2.2**	**2.9**
		(2.6 to 4.6)	(1.3 to 2.7)	(1.4 to 3.0)	(2.0 to 3.8)
ON	**Injury**	32	18.6	6.2	14.5
		(27.9 to 36.1)	(15.5 to 21.7)	(4.4 to 8.0)	(11.7 to 17.3)
	Death	3.3	1.5	1.9	3.1
		(2.0 to 4.6)	(0.6 to 2.4)	(0.9 to 2.9)	(1.8 to 4.4)
MB	**Injury**	1	#	1	#
		(-0.4 to 2.4)		(-0.4 to 2.4)	
	Death	8.3	#	2.4	#
		(4.4 to 12.2)		(0.3 to 4.5)	
SK	**Injury**	#	#	#	#
	Death	0	0	#	#
AB	**Injury**	10.9	9.2	16.1	43.8
		(6.8 to 15.0)	(5.4 to 13.0)	(11.1 to 21.1)	(35.6 to 52.0)
	Death	#	#	2	3.6
				(0.2 to 3.8)	(1.2 to 6.0)
BC	**Injury**	12.3	8.2	12.3	23.8
		(8.1 to 16.5)	(4.8 to 11.6)	(8.1 to 16.5)	(18.0 to 29.6)
	Death	0.8	1.2	2	3.6
		(-0.3 to 1.9)	(-0.1 to 2.5)	(0.3 to 3.7)	(1.3 to 5.9)

# denotes cells with more than 0 counts and fewer than 5 counts

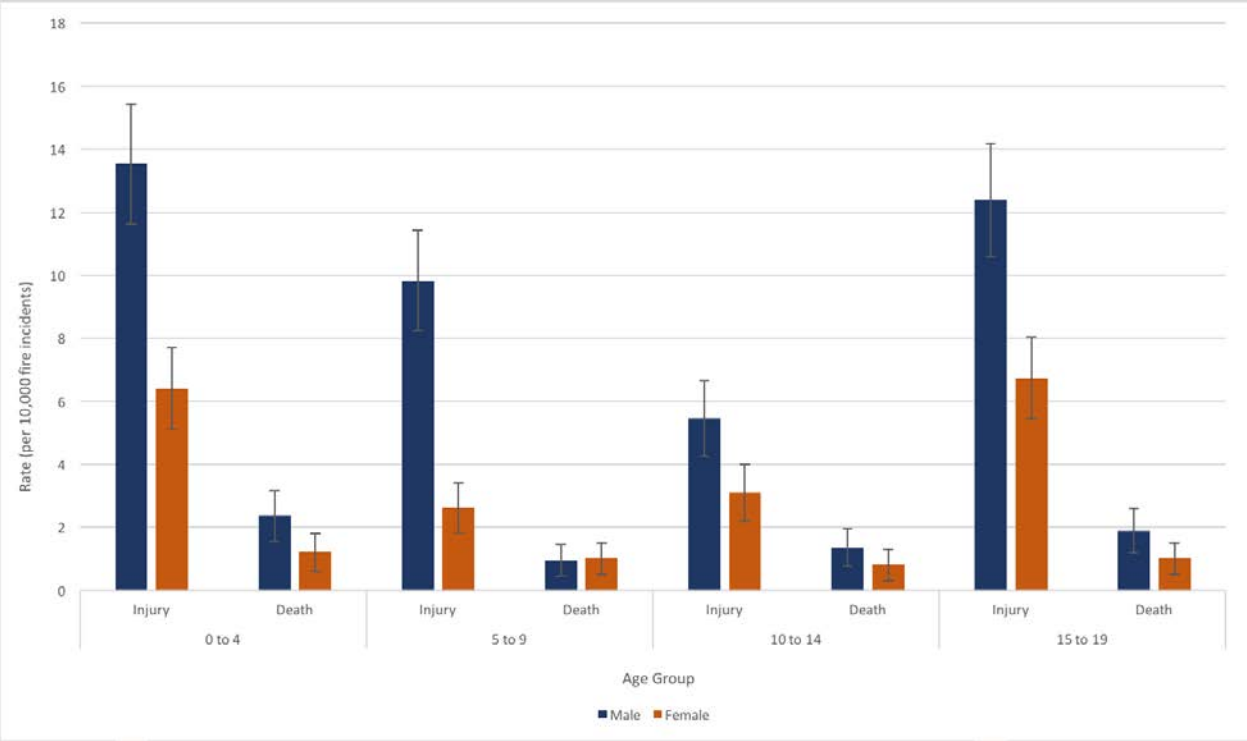
The top two causes of injuries and deaths among children and youth were smoke inhalation and burns. Figure 2 illustrates the rate of casualties for each cause. The 15-19 year-olds had the highest rates of casualties resulting from smoke inhalation and burns. The youngest children suffered the second highest rate from smoke inhalation, but in general, there is a positive relationship between increasing child age and rate of burn casualty.

FIGURE 2: TOP TWO CAUSES OF FIRE RELATED CASUALTIES BY AGE GROUP, CHILDREN AND YOUTH, CANADA, 2005 TO 2015



Males suffered higher rates of injuries and death in residential fires, relative to females, with the exception of the 5 to 9 age group (Figure 3). Deaths and injuries by sex and age are shown in Appendix B.

FIGURE 3: RATE OF FIRE RELATED INJURIES AND DEATH BY AGE GROUP AND SEX, CHILDREN AND YOUTH, CANADA, 2005 TO 2015



Note: 4,676 casualties were missing age information and 7 casualties in the 0 to 19 category were missing gender information

Discussion

Among the provinces included in the study, Ontario had the highest number of fire incidents. However, the population of Ontario is between 2.9 times and 12 times larger than the other Canadian provinces, which likely accounts for the higher numbers of residential fires in this province. With the exception of Alberta, which experienced a spike in 2011 due to a wildfire in Slave Lake, the number of residential fires varied from month to month and year to year. Between 2005 and 2014, the number of fires in Canada ranged between some 1,500 fires in 2017 and approximately 1,000 in the years 2009-2014.

Of note, the death rate among children 0 to 4 years of age was substantially higher in Manitoba than in the other provinces; further, it was higher than Manitoba's injury rate. While this finding could be the consequence of very low numbers, it still raises concern. One reason for the lower injury rate could be that the children involved in residential fires may have died instead. This explanation, if true, would likely be the result of a number of related factors affecting the outcome of the fire incident, such as severity of the fire, response times of the local fire crews, response times of the local medical emergency services, or distance from the nearest pediatric care facility.

Children and youth are vulnerable to injury and death in residential fires for a number of reasons. Babies and young children succumb more quickly to the effects of heat, smoke and carbon

monoxide because of their immature physiology and lower body mass.[14] Further, some research has shown that young children are not reliably roused by the sound of an alarm at night, and are not necessarily able to recognize the danger or respond to the alarm appropriately when they do wake.[1] Lastly, young children and babies are physically and developmentally unable to escape the home without assistance, leading to entrapment in the event that older siblings or caregivers are incapacitated.

Teenagers can also be considered a developmentally vulnerable group. Even though they are more mobile than younger children, and therefore theoretically able to escape the fire, they may remain in the building to help others escape, or to salvage important items. Adolescence is also a period of experimentation and risk-taking, rendering this group more likely to be under the influence of alcohol or drugs, or to bring smoking paraphernalia into the home, both known risk factors for fire-related casualties.[14]

As expected, there were more injuries than deaths, as well as more male than female casualties, across all child and youth age categories. Canadian males over the age of two years old are between two and four times more likely to sustain an injury, relative to females, across most causes of injury – including, but not limited to, fire injuries.[14] The reasons for this are the result of a complex interplay between social, cultural, psychological, physiological, economic, and situational factors at different stages of the lifespan.

Recommendations

- Promote parent knowledge of fire-related risks associated with developmental stage and sex;
    - Partnerships with local health units may facilitate knowledge transfer to parents of young children through community programming or during clinic visits.
- Promote awareness among teenagers of the unintended causes of residential fire injuries, as well as the risks that the presence of smoking materials poses to younger children in the home;
    - Partnerships with organizations that provide educational programs to teens, such as the Canadian Red Cross through the Babysitting and First Aid at Home courses, may allow for targeted delivery of relevant content to those who care for younger children in the home.
- Further harmonize data collection practices across Canada to allow for inter-provincial comparisons.
    - Include a variable in the NFID to capture information about fire services response times to facilitate linkage with medical triage and trauma services data.

RISK AND VULNERABILITY

Results

While Ontario and Saskatchewan did not provide building construction information, data from the remaining provinces indicate that the greatest proportion of fires occurred in homes of protected combustible construction (wood protected by plaster) (21.6%), combustible construction (open wood joist) (8.6%), and protected non-combustible construction (protected steel or concrete) (1.7%). Alberta reported very high casualty rates in fires in the protected non-combustible construction category: approximately 1,900 casualties per 10,000 fires, compared to the Canadian average of 830 casualties per 10,000 fires. The number of casualties and fire incidents by construction type and province, as well as the breakdown of construction type by age category, are provided in Appendix C.

There was a positive relationship between the spread of fire and the casualty rate, as the fire spread beyond the igniting object, to the room, and then the floor of origin in the residence. However, once the fire spread past the floor of origin, the casualty rate then declined. The majority of fire incidents and fires resulting in casualties occurred in the kitchen/cooking area (21.0%), bedroom (7.1%) and lounge/living room (7.0%). The ignition source did not affect the pattern of casualty rates among children and youth. Descriptive tables are shown in Appendix C.

Working smoke alarms were associated with fewer deaths, relative to no smoke alarms or smoke alarms that were not working. Conversely, structures with a working smoke alarm were associated with higher rates of injuries relative to no smoke alarms. Structures with sprinkler protection were associated with lower rates of death and higher rates of injuries among adults, while there was a decrease in both death and injury rates among children and youth. Table 2 and Table 3 show rates of injuries and deaths among children and youth. Descriptive tables regarding smoke alarms and sprinkler systems by provinces are shown in Appendix C.

TABLE 2: CASUALTIES BY PRESENCE AND ACTIVATION OF SMOKE ALARMS, CHILDREN AND YOUTH, CANADA, 2005 TO 2015

		Smoke Alarm					
		Present - Activated	Present - Not Activated	Not Present	Unknown/ Missing	N/A	Totals
Total Fires	N (%)	42,761 (28.8%)	16,660 (11.2%)	29,556 (19.9%)	47,024 (31.7%)	12,513 (8.4%)	148,513 (100.0%)
All Fires	Injury (Rate)	374 (87.5)	157 (94.2)	102 (34.5)	266 (56.6)	0 (0.0)	899 (60.5)
	Death (Rate)	31 (7.2)	33 (19.8)	38 (12.9)	52 (11.1)	#	157 (10.6)
0 to 4	Casualties (Rate)	149 (34.8)	48 (34.8)	32 (10.8)	117 (24.9)	0 (0.0)	346 (23.3)
5 to 9		80 (18.7)	37 (22.2)	20 (6.8)	74 (15.7)	#	214 (14.4)
10 to 14		57 (13.3)	25 (15.0)	31 (10.5)	47 (10.0)	0 (0.0)	160 (10.8)
15 to 19		119 (27.8)	70 (42.0)	47 (19.3)	81 (17.2)	0 (0.0)	317 (21.3)

# denotes cells with more than 0 counts and fewer than 5 counts

TABLE 3: CASUALTIES BY PRESENCE OF SPRINKLERS, CHILDREN AND YOUTH, CANADA 2005 TO 2015

		Sprinkler Protection				
		Yes	No	Unknown/ Missing	N/A	Totals
Total Fires	N (%)	4,248 (2.9%)	77,653 (52.3%)	54,800 (36.9%)	11,812 (8.0%)	148,513 (100.0%)
0 to 19	Injury (Rate)	12 (28.2)	319 (41.1)	524 (95.6)	26 (22.0)	881 (59.3)
	Death (Rate)	0 (0.0)	67 (8.6)	80 (14.6)	#	149 (10.0)
0 to 4	Casualties (Rate)	#	55 (7.1)	232 (42.3)	5 (4.2)	296 (19.9)
5 to 9		0 (0.0)	21 (2.7)	32 (5.8)	0 (0.0)	53 (3.6)
10 to 14		#	42 (5.4)	137 (25.0)	#	182 (12.3)
15 to 19		0 (0.0)	13 (1.7)	12 (2.2)	0 (0.0)	25 (1.7)

# denotes cells with more than 0 counts and fewer than 5 counts

Discussion

Environmental and circumstantial factors, such as the type of construction, where the fire started, the source of the ignition and how far the fire spread, did not appear to affect the overall patterns of child and youth injuries and deaths: children aged 0-4 years and 15-19 years suffered the highest casualty rates, when compared to other age groups. This does not necessarily indicate that targeted interventions to increase the fire resistance of the home environment would be ineffective; it is more likely an indication of the vulnerability of this population in any fire, in addition to the effects of other external factors that contribute to the extent and severity of the fire incident, such as firefighter deployment and response times.

As expected, fires in dwellings constructed of combustible materials resulted in the highest casualty rates. Of note, protected, non-combustible construction had the second highest casualty rates. Again, this finding does not necessarily indicate that these homes were unsafe; it may instead indicate that these fires tended to be particularly severe, or the children and youth living in these residences were not able to escape for other reasons. For example, many high-rise condominium buildings are constructed of fire-resistant materials, but children living in these types of buildings at the time of the fire incidents may have been prevented by the location of the fire from accessing the fire escapes or stairwells, or were too young to seek them out.

A potentially important environmental factor to consider would be the condition of the home. Although the year that the building was constructed was available in the dataset, and age of the dwelling could have been calculated, this step was omitted from the current study because such data does not necessarily reflect the condition of the building. Any renovations or upgrades to the structure or features of the home could not be accounted for, and therefore taken into consideration, in the discussion of environmental vulnerabilities associated with fire casualties among children and youth.

Lastly, working smoke alarms – and to an even greater degree, sprinklers – were associated with much lower death rates across all age groups. Previous research has shown that providing homes with working smoke alarms is an effective intervention to reduce fire-related deaths.[15] As discussed in the previous section of this report, the evidence for smoke alarm effectiveness with respect to the pediatric population is less assuring.[16] In addition to the reduced likelihood of awakening a sleeping child, smoke alarms have been found to have no protective effect among children caught in house fires caused by fire play.[7] Istre *et. al.* proposed that this might be explained by the children's behaviour after igniting the fire, or the smoke alarm being located in another part of the structure and at a distance from the source of the ignition.[7] However, this study shows a dramatic association between the presence of a working sprinkler and reduced deaths. Given the limitations of smoke alarms with respect to the unique patterns of behavioural responses of children, this result would appear to be consistent with the efficacy of sprinklers in the absence of a specific behavioural response. Sprinklers do not require the individual to respond at all, and therefore can be considered an effective, though costly[f], intervention for children.

Recommendations

- Continued installation and maintenance of smoke alarms;
    - Regular testing of smoke alarms
- Continued installation of sprinklers in residential buildings;
- Promote child knowledge in fire prevention and fire safety;
    - Recognizing fire hazards and fire hazardous materials
    - How to exit the building safely when the smoke alarm activates
- Improve collection of information about smoke alarms and sprinklers to help build sufficient evidence in the NFID to support updating building codes and related policies that will ensure smoke alarms and sprinklers are present and working in more homes;
- Work with municipalities to expand programs that deliver working smoke alarms to homes in low-income neighbourhoods, particularly to lone-parent families;
- Consider adding an educational component to smoke alarm programs to ensure that parents and older children are aware of the limitations of smoke alarms with respect to young children, and support these families in planning accordingly;
- Review existing building codes and policies for provisions for children and youth with respect to smoke alarms, sprinkler systems and escape routes;

[f] Canada Mortgage and Housing Corporation. "Research Highlight: Fire experience, smoke alarms and sprinklers in Canadian houses." *April 2005.* Available from: https://www03.cmhc-schl.gc.ca

- Include more information in the NFID regarding firefighter deployment, such as: the number of responders deployed, whether they were paid or volunteer, and the time elapsed between dispatch and arrival at the fire.

SOCIOECONOMIC AND GEOGRAPHIC FACTORS

Socioeconomic variables and geographical definitions

Census 2011 data was used to examine socioeconomic predictors of fire-related casualties. Three surrogate measures for socioeconomic status (SES) were selected: percentage of family dwellings in the selected geography that are single parent families; median after-tax income in thousands of dollars, all census families, for the selected geography; and percentage population aged 25 years and older without a certificate, diploma or degree.

Census data was presented at the CMA/CA[g] and CSD[h] levels. Although using more granular separations are generally preferred, aggregation at the CSD level resulted in 75% of CSD regions with fewer than 50 fire incidents across the 10-year span, whereas only 2% of CMA/CA regions had fewer than 50 fire incidents. With the low rates of residential fire casualties per fire incidents reported, it was not possible to model SES using CSD levels, so the SES values and aggregate counts at the CMA/CA level were used instead.

Data analysis

Number of casualties[i] was calculated for each CMA/CA as the outcome of interest. A Poisson regression model was applied to each population group (whole population, children and youth, and adults 25-years and older), with the number of casualties as the outcome variable of interest, the three SES variables, lone-parent, median income and lowest education as outcome predictors, with province as a categorical covariate (BC was used as the reference group), and offset by the total number of fire incidents. Thus, the association between the SES variables and fire casualty rate was explored while controlling for the province.

Results

P-values less than 0.05 were considered statistically significant. In all three models, jurisdiction showed the same significant trend. Relative to British Columbia, casualty rates were substantially lower in Manitoba (between 86.4%-92.8% lower) and rates in Ontario and Alberta were higher (between 15.4%-95.7% higher).

When the model was applied to the whole population, all three SES variables were significant. As expected, the percentage of lone-parent dwellings was positively associated with the casualty rate, and the median household income was negatively associated with the casualty rate. The model

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[g] Census metropolitan area and census agglomeration. See Statistics Canada website for detailed definitions: http://www12.statcan.gc.ca/census-recensement/2011/ref/dict/geo009-eng.cfm

[h] Census subdivision. See Statistics Canada website for detailed definitions: http://www12.statcan.gc.ca/census-recensement/2011/ref/dict/geo012-eng.cfm

[i] Because some CMA/CA had very low numbers, injuries and deaths were combined in order to perform the analysis.

showed that for each percent increase in single parent dwellings in the region, the casualty rate due to residential fires increased by 2.2%. For each $1,000 increase in median household income, the casualty rate decreased by 0.7%. However, the percentage of adults in the region with low education was negatively associated with the casualty rate. The model showed that for each percent increase in proportion of adult population without a certificate, diploma, or degree, the casualty rate decreased by 2.6%.

Children and youth

The model showed that the child and youth residential fire casualty rate was significantly associated with the percentage of lone-parent dwellings in the region. For each percent increase in single parent dwellings in the region, the casualty rate due to residential fires increased by 7.4%. Median income and low education were not significant in the model for children and youth. Table 4 displays the outputs of the model.

TABLE 4: POISSON REGRESSION MODEL OF CHILDREN AND YOUTH CASUALTY RATE (0-19 YEARS)

Children and Youth		
Variable	**Rate Ratio (95% CI)**	**p-value**
Lone-Parent*	1.074 (1.036 - 1.114)	0.0001
Median Income	1.003 (0.987 - 1.018)	0.7587
Lower Education	0.980 (0.951 - 1.011)	0.2053
ON*	1.534 (1.229 - 1.915)	0.0002
MB*	0.072 (0.033 - 0.155)	0.0001
AB*	1.753 (1.230 - 2.498)	0.0019

*Significant results at $p<0.05$; BC was the reference jurisdiction

Discussion

As one measure of socioeconomic status, adult education reflects an important determinant of child and youth well-being. Adults in the family are typically the parents and caregivers, and their socioeconomic status is directly related to the health and well-being of their children. In this study, the model showed that low levels of adult education were associated with elevated fire injury risk among the adult population. As potential parents and caregivers, this relationship between low education and fire injury risk may have implications for adults with children living in their homes.

According to Statistics Canada, in 2015, almost one in five Canadian children were living in low-income households.[17] Further, a recent report found that 50% of children in families in British Columbia live in poverty.[18] These figures are of concern, as poverty has a number of negative impacts on other social determinants of health, such as housing quality.[14]

Those living in substandard housing are at increased risk of being injured in a house fire, as established in the peer-reviewed literature.[6,7,10] According to Child Health BC's 2016 report, *Is "good" good enough? A report of the health and well-being of children and youth in British Columbia,*[19] the percentage of children and youth living in urban[j] BC with core housing need in 2011 was substantially higher than the national average and was the highest among all Canadian provinces.[19] Core housing need is the failure of the dwelling to meet at least one of the three required standards: adequacy, affordability and suitability.[19] While affordability is the key driver of this trend in British Columbia, failing to meet these standards can also mean that the homes are in need of major repairs or present crowded living conditions.[20] Children and youth who live in poor housing conditions are more susceptible to injuries such as falls and burns.[21] A recent review of child deaths in residential fires in British Columbia 2005-2014 by the BC Coroners Service, Child Death Review Unit (CDRU) found that children living in crowded, substandard housing were at greater risk of death.[1] Further, almost 60% of the fire incidents reviewed by the CDRU resulted in multiple fatalities. Future and ongoing studies of child and youth injury in residential fires should include socioeconomic and geographic risk factors, in addition to detailing the circumstances of the fire incident and outcomes, because not all children are equally at risk, and their vulnerability is inextricably linked to where and how they live.

Recommendations

- Continue to harmonize data collected across Canada and reduce inconsistencies and missing data fields;
    - Develop an online portal for members to access data collection training modules, standardized forms and a standardized data collection manual, as well as a means for resolving queries and tracking overall progress towards a more complete database.
    - Collect information regarding persons present in the home at the time of the fire who did not suffer any casualty.
- Interventions to prevent fires in low-SES neighbourhoods should include additional supports for lone-parent families.
    - Form partnerships with local community groups, NGOs, public health units, or the Ministry of Child and Family Development, to facilitate access to families at risk, as well as ensure that the delivery of any programs, services or resources is comprehensive and timely.

[j] Population of ≥ 10,000

Strengths and Limitations

STRENGTHS

One of the defining strengths of this study is that the NFID is a novel dataset. The BCIRPU is the first research organization to study the burden and epidemiology of residential fire-related injuries among Canadian children and youth using the information available in the NFID.

The NFID is the only database in Canada that provides detailed information regarding residential fire incidents and casualties from the past ten years. This data, available for the first time in Canada, allowed for an overview of fire incidence across and between Canadian provinces. The epidemiology, as well as the socioeconomic and geographical components of vulnerability among children and youth injured or killed in residential fires, has now been described in British Columbia, Alberta, Saskatchewan, Manitoba and Ontario.

LIMITATIONS

Completeness of data

The NFID provides fire incident and victim data from 2005 to 2015, which the exception of ON and SK, who provided 2005 to 2014, and 2012 to 2015, respectively. To accurately compare the overall burden of risk factors among provinces, data from all years should be provided by the provinces. However, with this current dataset, adequate information was available to permit comparisons.

Many variables were missing varying amounts of data, such that 31.7% of smoke alarm, 36.9% of sprinkler, and 59% of age data were missing. Importantly, from 2009 onwards in the province of Ontario, there appeared to be a sudden drop in casualties among all ages; however, the number of cases coded as "999" in the VICAGE variable jumped from 0 or 1 per year to over 600 per year, indicating a possible change in reporting/coding practices and resulting in significant missing data. Secondly, 7,848 (68.6%) casualties were of unknown or missing possible cause of injury or death (Appendix B). Of the 1,057 children and youth cases, 65.1% (688) were of unknown or missing cause. Lastly, 51.4% of construction type data was missing and 41.1% of fire spread data was unknown or missing (Appendix C). In further studies of fire injuries and deaths across Canada, reducing the number of unknown and missing entries, and inconsistencies across the dataset would be tremendously helpful for future analysis, particularly for meaningful comparisons between provinces.

Accuracy and reliability of data

The NFID is a large dataset, containing 129 incident and 31 victim variables. With a total of 467,929 incident records and 15,326 victim records, errors during data aggregation and coding are likely to occur, particularly because the coding of specific variables differs between provinces. For example, the *Nature of Casualties* variable was coded into five categories: death, minor injury, serious injury, injury seriousness unknown/undetermined/other, and missing. All provinces provided data for

minor injury and serious injury except Saskatchewan, which coded all injuries as unknown seriousness of injury.

The coding of "firefighter" and "civilian" was occasionally inconsistent with the age of the casualty, raising questions about the validity of the entry. For example, there were 8 cases of "firefighters" who, according to the data, were between 0 and 8 years of age, which suggests the possibility that the ages recorded for civilians may likewise not be accurate. To ensure that no possible cases of child and youth casualties were missed, these cases were included in the analyses. However, this decision precluded the exclusion of occupational casualties from the adult population. Thus, meaningful comparisons between age categories are limited and those that are presented should be interpreted with caution throughout this report. Further, adult casualty rates reported in this study include both civilian and firefighter casualties, therefore potentially obscuring an underlying pattern between civilians and firefighter injuries and deaths.

Limitations specific to the Poisson regression model of SES

Both incidents that result in deaths and injuries as well as incidents that do not result in injuries and deaths are required to adequately model risk. The methodology used to investigate the associations between SES parameters and fire injuries and deaths required aggregation of the data by region. However, low counts prevented the use of more granular level data (such as CSD), while the CMA/CA area that was necessarily used in this model may be too large to effectively model an association between SES and risk of fire casualties.

Ideally, the model would use SES data at a more granular level, such as CSD or postal code, as well as include the number of non-casualties at the case-by-case level. These variables currently exist in the NFID as the number of occupants in dwelling unit at the time of fire for senior citizens, adults, youth, and children, but are only reported by Alberta and many entries are missing or of dubious validity.

Conclusions

This report shows variation in the annual number of fire incidents between 2005 to 2014 in Canadian provinces that provided fire incidents and fire-related injury and death information to the National Firefighters Information Database. The noticeable spike in the number of fire incidents in 2011 is attributable to a single wild fire event in one province (Alberta), that affected a significant number of residential buildings, while the decreased number of fires in 2015 results from missing data from one province (Ontario). A high rate of injury and death in the youngest (0 to 4 years old) and eldest (15 to 19 years) age categories was observed, regardless of dwelling construction type, where the fire started in the home, or how far the fire spread. Casualty rates in the presence of working smoke alarms suggested a protective effect against child and youth deaths; however, the presence of activated sprinklers was associated with dramatically fewer deaths among children and youth. While more complete data is needed, these findings suggest that programs and policies to

increase the number of family homes with working smoke alarms and sprinkler systems should be continued and expanded. Lastly, interventions targeted to low socioeconomic status neighbourhoods, particularly those with a high proportion of lone-parent families, are recommended, and may be facilitated through partnerships with public, private and not-for-profit organizations that serve the most vulnerable families.

SUMMARY RECOMMENDATIONS

Data collection

- Standardize data collected across Canada and reduce inconsistencies and missing data fields;
    - Ensure accurate documentation of age for injuries and deaths, as well as information about smoke alarms and sprinkler systems, through standardized forms and training in standardized data collection protocols.
- Further harmonize data collection practices across Canada to allow for inter-provincial comparisons;
    - Provide standard input sheets to all firefighters across Canada, as well as a data collection manual and training on standardized procedures for data collection, potentially through an online platform;
    - Integrate into the online platform a system for tracking progress towards a more complete and reliable database, as well as for resolving data collection issues and queries.
- Include a variable in the NFID to capture consistent and complete information on firefighter dispatch and response times;
    - Include a variable in the NFID to capture information about fire services response times to facilitate linkage with medical triage and trauma services data;
    - Capture firefighting deployment data to provide additional context for severity of fire outcomes;
    - In the case of a fire department that deployed both paid and volunteer firefighters, quantify how many of each, volunteer and paid firefighters, responded to the fire incident.
- Include a variable in the NFID to capture the number of persons present in the home at the time of the fire who did not suffer a casualty, including zero, to allow for more precise modelling of risk using statistical methods.

Fire prevention and fire safety promotion

- Promote parent knowledge of fire-related risks associated with developmental stage and sex;
    - Partnerships with local health units may facilitate knowledge transfer to parents of young children through community programming or during clinic visits.
- Promote awareness among teenagers of the unintended causes of residential fire injuries, as well as the risks that the presence of smoking and open flame materials pose to younger children in the home;

    - Partner with organizations that provide teen education for childcare and first aid in the home to ensure relevant content is included in the curriculum
    - Continue efforts to promote child knowledge of fire prevention and fire safety
- Improve collection of information about smoke alarms and sprinklers to reduce missing data in the NFID;
- Continue and expand existing programs that provide working smoke alarms to homes in low-income neighbourhoods, particularly to lone-parent families. Consider including an educational component to ensure families are aware that younger children may not wake up or respond to the alarm as expected, and support these families in developing an appropriate safety plan;
- Review existing building codes and related policies for child- and youth-friendliness, particularly with respect to smoke alarms, sprinkler systems and escape routes;
- Focus preventative interventions on low-SES neighbourhoods;
    - Provide additional education and supports to lone-parent families, potentially through partnerships with local community groups, NGOs, or the MCFD
- Foster local and regional partnerships between firefighting services and child and family services to improve the coordination, delivery and impact of preventative programming.

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Appendices

APPENDIX A – DESCRIPTIVE VARIABLES

Predictor variables

The variables of interest included year of fire incident, age of the casualty, type of material used for the construction of the residential building, the presence of smoke alarm and the use of sprinklers.

Age categories were sorted according to their respective age groups, with a primary focus on children and youth:

- **Children and youth: ≤19 years of age**
- Young adults: 20 to 24 years of age
- Adults: 25 to 54 years of age
- Older adults: ≥55 years of age

Young adults were isolated as a buffer group between children and youth who are more likely to live at home with one or more caregivers, and adults aged 25 and older who are likely to more likely to live independently from their former caregivers. In this context, young adults aged 20 to 24 years were considered a transitional group for the purposes of this report, as they may or may not live independently.

Type of Construction was defined by the General Construction variable, which related specifically to the Property Classification. The types of construction that were defined by the variable included: combustible construction - open wood joist; protected combustible construction - wood protected by plaster; heavy timber construction; non-combustible construction - exposed steel; protected non-combustible construction - protected steel or concrete; as well as unclassified, unknown, not applicable, and missing data.

The presence of a smoke alarm was recoded from the Performance of Smoke Alarm Device variable. The new codes included smoke alarm present – activated, smoke alarm present – not activated, smoke alarm not present, not applicable, and unknown/missing.

- Present – activated: Alarm in room of origin – activated, Alarm not in room of origin – activated; Alarm location unknown – activated.
- Present – not activated: Alarm not in room of origin – activated; Alarm in room of origin – not activated – non-suitable location; Alarm in room of origin – not activated – battery dead; Alarm in room of origin – not activated – no battery; Alarm in room of origin – not activated – AC not connected/disabled; Alarm in room of origin – not activated – mechanical failure; Alarm not in room of origin – not activated – battery dead; Alarm not in room of origin – not activated – no battery; Alarm not in room of origin – not activated – AC not connected/disabled; Alarm not in room of origin – not activated – mechanical failure; Not enough smoke to activate smoke alarm; Alarm location unknown – not activated - non-suitable location; Alarm location unknown – not activated – no battery or battery dead; Alarm location unknown – not activated – AC not connected/disabled; Alarm location unknown – not activated – mechanical failure.

- Not present: No smoke alarm.
- Unknown/Missing: Smoke alarm activation – unknown and blanks.
- N/A: Not applicable because the fire could have been outside the residential building.

Similarly, the Sprinkler Protection variable was recoded to reflect the presence, absence, unknown status or missing sprinkler system.

- Present: Complete sprinkler protection and partial sprinkler protection.
- Not Present: No sprinkler protection.
- Unknown/Missing: Sprinkler protection – unclassified, cannot be determined, and missing data.
- N/A – Vehicle, outside area, etc. remained coded as not applicable.

Other Variables

Possible cause of injury or death was categorized as smoke inhalation, burn, other, unknown, or missing. Our analysis focused specifically on smoke inhalation and burns in children and youth.

Extent of fire spread was classified using the following:

- Confined to object of origin
- Confined to part of room/area of origin
- Confined to room of origin
- Confined to floor level of origin, which included spread beyond room of origin; multi-unit dwelling – spread beyond room of fire origin, same floor, outside unit; multi-unit-dwelling – Spread beyond room of fire origin, same floor, separate unit; spread beyond suit or apartment, same floor; and spread to additional suit or apartment, same floor
- Confined to building of origin, which included spread beyond floor of fire origin, different floor; spread to entire structure
- Extended beyond building of origin
- Confined to roof
- Not applicable - vehicle or outside area
- Extent of fire unclassified or unknown
- Missing

Origin of fire had three categories of interest: kitchen, cooking area; lounge, living room (includes music room, common room, TV room, den, recreation room, family room, sitting room); and bedroom - sleeping under 5 occupants (includes patients' room, bedroom, cell, lockup).

Igniting object that contributed to the residential fire incident and fire-related injury or death represented three categories of interest: cooking equipment, heating equipment, and smoker's material and "open" flame.

Missing**:** There were some provinces that did not provide data for certain variables or labeled specific variable as unknown or missing data.

- New Brunswick did not provide residential information
- Saskatchewan did not provide 2005 to 2011 data, while Ontario did not provide 2015 data
- Ontario did not provide residential construction type
- Ontario and MB did not provide possible cause of injury or death data
- Saskatchewan provided casualty data as death or unknown seriousness of injury
- Saskatchewan only provided unknown/missing sprinkler information

Formulae

Calculating the rate of casualties in British Columbia

$$Rate = \frac{number\ of casualties}{(total\ number\ of\ fire\ incidents\ in\ BC)}\ x\ 10{,}000\ fires$$

Example: Rate of children and youth (0 to 19 years) injuries in British Columbia

$$Rate = \frac{521\ injuries}{26{,}839\ fire\ incidents\ in\ BC}\ x\ 10{,}000\ fires$$

$$Rate = 56.6\ injuries\ per\ 10{,}000\ fires\ in\ BC$$

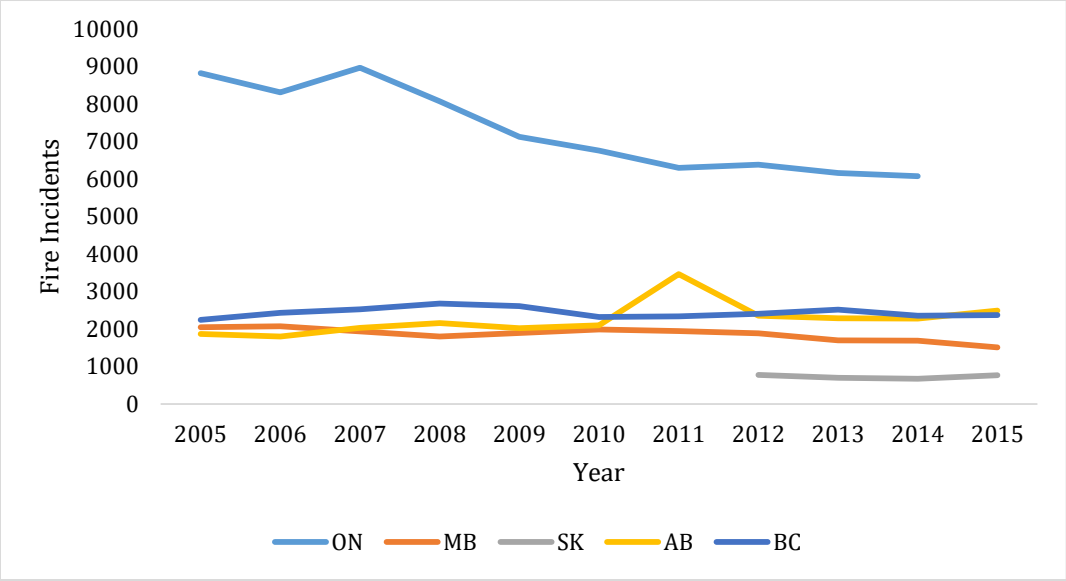
APPENDIX B – FIRE INCIDENTS IN CANADA, ADDITIONAL FIGURES AND TABLES

TABLE B1: FIRE INCIDENTS BY YEAR, CANADA, 2005 TO 2015

Year of Incident	Frequency	Percent (%)
2005	15,035	10.1
2006	14,653	9.9
2007	15,504	10.4
2008	14,763	9.9
2009	13,717	9.2
2010	13,217	8.9
2011	14,102	9.5
2012	13,843	9.3
2013	13,396	9.0
2014	13,114	8.8
2015	7,169	4.8
Total	**148,513**	**100**

Note: ON did not provide 2015 data. Percentage does not add to 100% due to rounding.

FIGURE B1: NUMBER OF FIRE INCIDENTS BY YEAR AND PROVINCES, 2005 TO 2015



Note: BC, AB, MB, provided all data from 2005 to 2015, ON provided data from 2005 to 2014, and SK provided data from 2012 to 2015. CAF was not included in the graph as their fire incidence was too low to capture.

TABLE B2: RATES OF INJURIES AND DEATHS, BY AGE CATEGORY AND PROVINCE, 2005 TO 2015

Province	Rate	0 to 19 years	20 to 24 years	25 to 54 years	55 and older
All	**Injury**	**60.5**	**25.9**	**206.6**	**64.6**
	Death	**10.6**	**4.4**	**37.0**	**46.3**
ON	**Injury**	71.3	17.0	196.1	42.6
	Death	9.9	3.8	35.7	48.9
MB	**Injury**	9.8	2.4	20.5	3.9
	Death	14.6	5.4	27.8	35.1
SK	**Injury**	9.8	2.4	20.5	3.9
	Death	10.3	0.0	24.0	24.0
AB	**Injury**	80.0	55.9	334.1	125.4
	Death	7.6	3.6	52.3	41.4
BC	**Injury**	56.6	43.2	279.8	119.2
	Death	12.3	6.7	35.4	55.1

FIGURE B2: NUMBER OF INJURIES AND DEATHS BY POSSIBLE CAUSE, CANADA, 2005 TO 2015

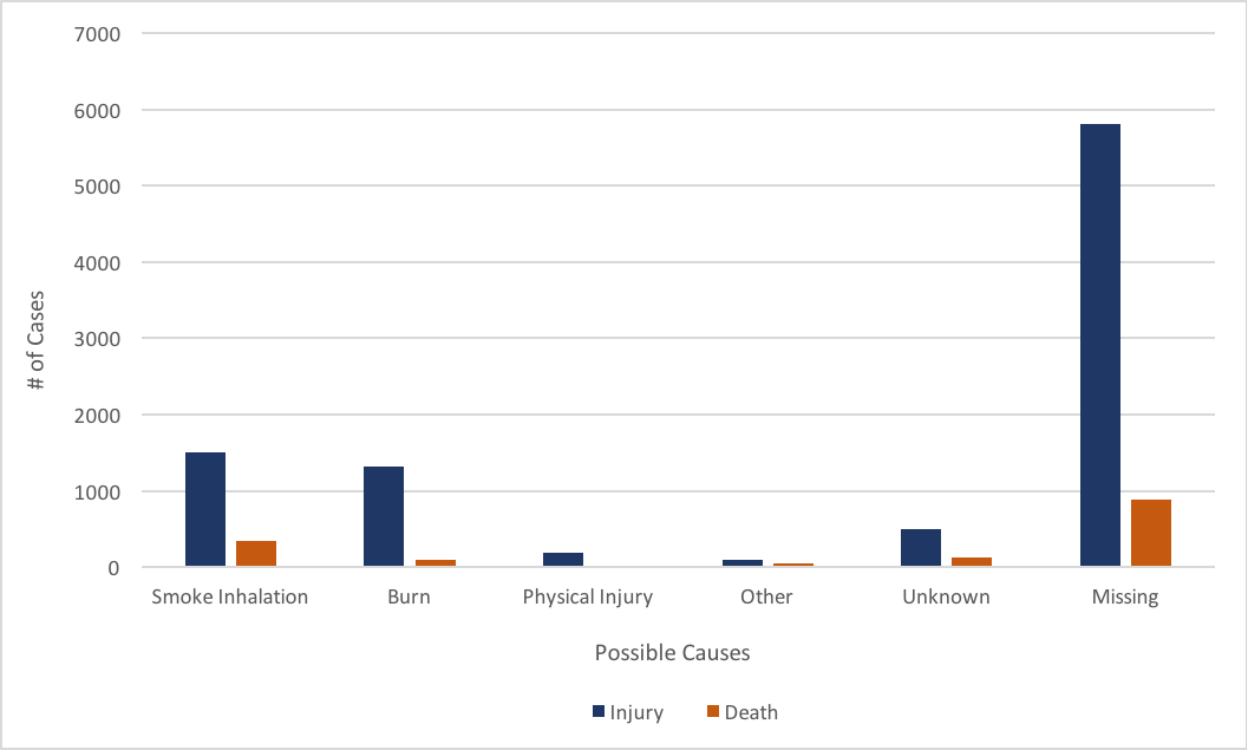
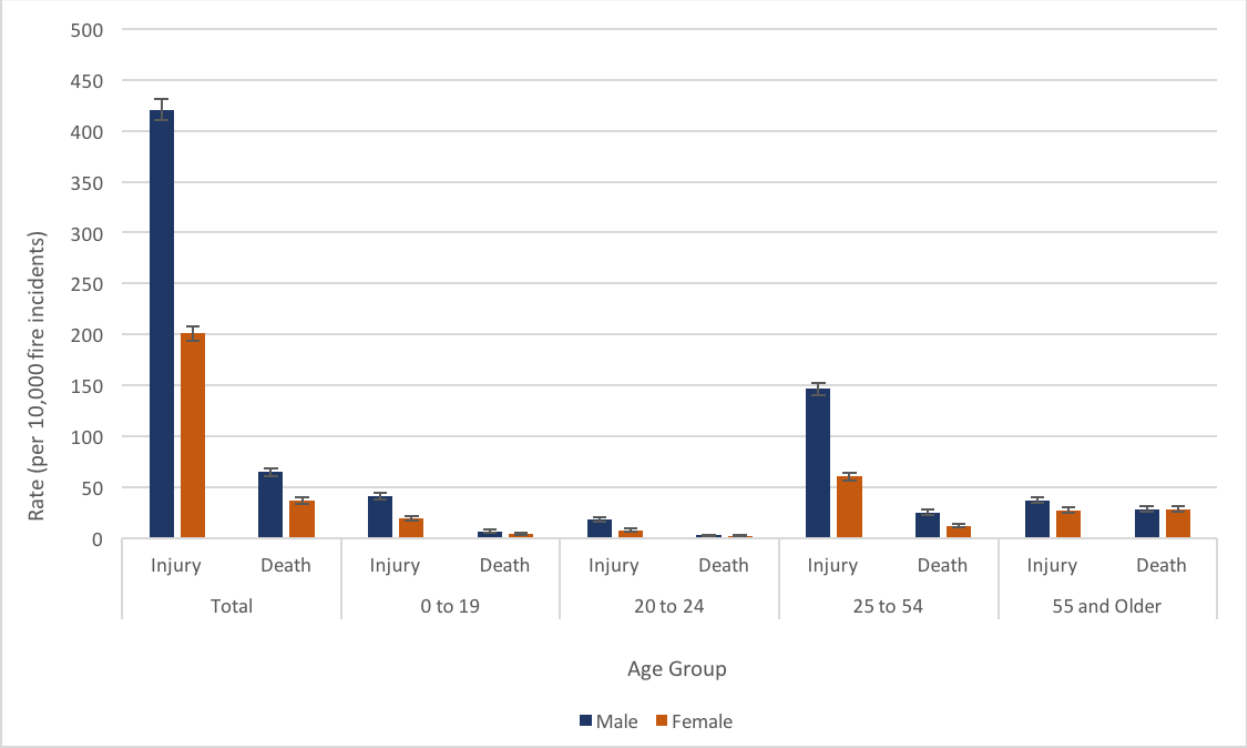


FIGURE B3: RATE OF INJURIES AND DEATHS BY AGE AND SEX, 2005 TO 2015



APPENDIX C – RISK FACTORS AND VULNERABILITIES, ADDITIONAL FIGURES AND TABLES

TABLE C1: NUMBER AND RATE OF CASUALTIES BY CONSTRUCTION TYPE AND PROVINCE, 2005 TO 2015

		Combustible Construction (Open Wood Joist)	Protected Combustible Construction (Wood Protected by Plaster)	Heavy Timber Construction	Non-combustible Construction (Exposed Steel)	Protected Non-combustible Construction (Protected Steel or Concrete)	General Construction (Not Applicable)	General Construction (Unclassified)	General Construction (Unknown)	Missing	Totals
Total Fires	**N (%)**	**12,807 (8.6%)**	**32,102 (21.6%)**	**533 (0.4%)**	**278 (0.2%)**	**2,534 (1.7%)**	**9,337 (6.3%)**	**7,688 (5.2%)**	**6,945 (4.7%)**	**76,289 (51.4%)**	**148,513 (100.0%)**
	Casualties (Rate)	**695 (542.7)**	**2,826 (880.3)**	**37 (694.2)**	**10 (359.7)**	**211 (832.7)**	**135 (144.6)**	**292 (379.8)**	**181 (260.6)**	**7,061 (925.6)**	**11,448 (770.8)**
ON	Fires	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	73,028 (100.0%)	73,028 (100.0%)
	Casualties	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	6,985 (956.5)	6,985 (956.5)
MB	Fires	3,089 (15.1%)	3,878 (18.9%)	77 (0.4%)	106 (0.5%)	861 (4.2%)	5,625 (27.4%)	4,721 (23.0%)	2,153 (10.5%)	0 (0.0%)	20,510 (100.0%)
	Casualties	40 (129.5)	101 (260.4)	#	0 (0.0)	18 (209.1)	#	66 (139.8)	12 (55.7)	0 (0.0)	245 (119.5)
SK	Fires	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2,921 (100.0%)	2,921 (100.0%)
	Casualties	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	76 (260.2)	76 (260.2)
AB	Fires	5,999 (24.1%)	11,749 (47.2%)	215 (0.9%)	69 (0.3%)	513 (2.1%)	2,996 (12.0%)	859 (3.5%)	2,475 (9.9%)	0 (0.0%)	24,875 (100.0%)
	Casualties	366 (610.1)	1,228 (1,045.2)	17 (790.7)	#	99 (1,929.8)	94 (313.8)	55 (640.3)	65 (262.6)	0 (0.0)	1,926 (774.3)
BC	Fires	3,719 (13.9%)	16,475 (61.4%)	241 (0.9%)	103 (0.4%)	1,160 (4.3%)	716 (2.7%)	2,108 (7.9%)	2,317 (8.6%)	0 (0.0%)	26,839 (100.0%)
	Casualties	289 (777.1)	1,497 (908.6)	16 (663.9)	8 (776.7)	94 (810.3)	37 (516.8)	171 (811.2)	104 (448.9)	0 (0.0)	2,216 (825.7)

# denotes cells with more than 0 counts and fewer than 5 counts

TABLE C2: RATE OF CASUALTIES BY CONSTRUCTION TYPE AND AGE, CANADA, 2005 TO 2015

		Combustible Construction (Open Wood Joist)	Protected Combustible Construction (Wood Protected by Plaster)	Heavy Timber Construction	Non-combustible Construction (Exposed Steel)	Protected Non-combustible Construction (Protected Steel or Concrete)	General Construction (Not Applicable)	General Construction (Unclassified)	General Construction (Unknown)	Missing
Total Fires	**N (%)**	**12807 (8.6%)**	**32102 (21.6%)**	**533 (0.4%)**	**278 (0.2%)**	**2534 (1.7%)**	**9337 (6.3%)**	**7688 (5.2%)**	**6945 (4.7%)**	**76289 (51.4%)**
All Fires	**Casualties (Rate)**	695 (542.7)	2,826 (880.3)	37 (694.2)	10 (359.7)	211 (832.7)	135 (144.6)	292 (379.8)	181 (260.6)	7,061 (925.6)
0 to 19 years		87 (67.9)	308 (95.9)	#	0	9 (35.5)	11 (11.8)	16 (20.8)	18 (25.9)	604 (79.2)
20 to 24 years		50 (39.0)	207 (64.5)	#	0	12 (47.4)	#	15 (19.5)	7 (10.1)	152 (19.9)
25 to 54 years		332 (259.2)	1,233 (384.1)	14 (262.7)	8 (287.8)	72 (284.1)	65 (69.6)	125 (162.6)	57 (82.1)	1,713 (224.5)
55 years and older		128 (99.9)	593 (184.7)	11 (206.4)	#	74 (292.0)	40 (42.8)	73 (95.0)	42 (60.5)	683 (89.5)

# denotes cells with more than 0 counts and fewer than 5 counts

TABLE C3: NUMBER OF CASUALTIES BY FIRE SPREAD AND AGE, CANADA, 2005 TO 2015

		Confined to Object of Origin	Confined to Part of Room/Area of Origin	Confined to Room of Origin	Confined to Floor Level of Origin	Confined to Building of Origin	Extended Beyond Building of Origin	Confined to Roof	N/A	Unclassified/ Unknown	Missing
Total Fires	**N (%)**	**26,745 (18.0%)**	**22,378 (15.1%)**	**6,505 (4.4%)**	**5,286 (3.6%)**	**16,430 (11.1%)**	**5,217 (3.5%)**	**2,117 (1.4%)**	**2,779 (1.9%)**	**40,206 (27.1%)**	**20,850 (14.0%)**
All Fires	**Injury (Rate)**	1,022 (382.1)	2,144 (958.1)	841 (1,292.9)	886 (1,676.1)	1,469 (894.1)	376 (720.7)	72 (340.1)	61 (219.5)	2,467 (613.6)	75 (36.0)
	Death (Rate)	87 (32.5)	139 (62.1)	101 (155.3)	273 (516.5)	527 (894.1)	60 (115.0)	0 (0.0)	42 (151.1)	108 (26.9)	170 (81.5)
0 to 19	**Injury**	48 (17.9)	82 (36.6)	61 (93.8)	66 (50.5)	83 (50.5)	21 (40.3)	#	9 (32.4)	508 (126.3)	20 (9.6)
	Death	5 (1.9)	8 (3.6)	8 (12.3)	30 (37.7)	62 (37.7)	#	0 (0.0)	#	9 (2.2)	30 (14.4)
20 to 24	**Injury**	36 (13.5)	65 (87.6)	57 (87.6)	23 (43.5)	52 (31.6)	20 (38.3)	#	#	123 (30.6)	5 (2.4)
	Death	#	#	7 (10.8)	13 (24.6)	24 (14.6)	#	0 (0.0)	#	#	11 (5.3)
25 to 54	**Injury**	172 (64.3)	428 (382.8)	249 (382.8)	193 (365.1)	422 (256.8)	133 (254.9)	#	35 (125.9)	1,393 (346.5)	42 (20.1)
	Death	20 (7.5)	52 (55.3)	36 (55.3)	104 (196.7)	194 (118.1)	29 (55.6)	0 (0.0)	15 (54.0)	43 (10.7)	57 (27.3)
55+	**Injury**	102 (38.1)	162 (159.9)	104 (159.9)	61 (115.4)	152 (92.5)	35 (67.1)	#	12 (43.2)	320 (79.6)	8 (3.8)
	Death	56 (20.9)	75 (33.5)	49 (75.3)	122 (230.8)	222 (135.1)	25 (47.9)	0 (0.0)	21 (75.6)	45 (11.2)	72 (34.5)

# denotes cells with more than 0 counts and fewer than 5 counts

TABLE C4A: NUMBER AND RATE OF CASUALTIES BY LOCATION OF FIRE AND AGE, CANADA, 2005 TO 2015

		Kitchen, Cooking Area	Lounge, Living Room	Bedroom (Under 5 Occupancy)
Total Fires	**N (%)**	**31,143 (21.0%)**	**10,330 (7.0%)**	**10,613 (7.1%)**
All Fires	**Injury (Rate)**	**3,138 (1,007.6)**	**1,210 (1,171.3)**	**1,427 (1,344.6)**
	Death (Rate)	**202 (64.9)**	**413 (399.8)**	**279 (262.9)**
0 to 19	**Injury**	335 (107.6)	134 (129.7)	153 (144.2)
	Death	18 (5.8)	43 (41.6)	22 (20.7)
20 to 24	**Injury**	148 (47.5)	48 (46.5)	74 (69.7)
	Death	10 (3.2)	22 (21.3)	9 (8.5)
25 to 54	**Injury**	926 (297.3)	368 (356.2)	497 (468.3)
	Death	72 (23.1)	150 (145.2)	112 (105.5)
55+	**Injury**	322 (103.4)	153 (148.1)	154 (145.1)
	Death	93 (29.9)	195 (188.8)	135 (127.2)

TABLE C4B: NUMBER AND RATE OF CASUALTIES BY LOCATION OF FIRE, CHILDREN AND YOUTH, CANADA, 2005 TO 2015

		Kitchen, Cooking Area	Lounge, Living Room	Bedroom (Under 5 Occupancy)
Total Fires	**N (%)**	**31,143 (21.0%)**	**10,330 (7.0%)**	**10,613 (7.1%)**
All Fires	**Injury (Rate)**	**335 (107.6)**	**134 (129.7)**	**153 (144.2)**
	Death (Rate)	**18 (5.8)**	**43 (41.6)**	**22 (20.7)**
0 to 4	**Injury**	109 (35.0)	50 (48.4)	42 (39.6)
	Death	#	20 (19.4)	11 (10.4)
5 to 9	**Injury**	61 (19.6)	31 (30.0)	35 (33.0)
	Death	#	8 (7.7)	#
10 to 14	**Injury**	47 (15.1)	23 (22.3)	18 (17.0)
	Death	#	#	#
15 to 19	**Injury**	118 (37.9)	30 (29.0)	58 (54.6)
	Death	9 (2.9)	11 (10.6)	#

# denotes cells with more than 0 counts and fewer than 5 counts

TABLE C5A: NUMBER AND RATE OF CASUALTIES BY IGNITING GROUP AND AGE, CANADA, 2005 TO 2015

		Cooking Equipment	Heating Equipment	Smoker's Material and Open Flame
Total Fires	**N (%)**	**29,567 (19.9%)**	**16,283 (11.0%)**	**28,568 (19.2%)**
All Fires	**Injury (Rate)**	2,998 (1,014.0)	528 (324.3)	2,236 (782.7)
	Death (Rate)	133 (45.0)	72 (44.2)	522 (182.7)
0 to 19	**Injury**	327 (110.6)	62 (38.1)	205 (71.8)
	Death	12 (4.1)	11 (6.8)	50 (17.5)
20 to 24	**Injury**	149 (50.4)	19 (11.7)	105 (36.8)
	Death	10 (3.4)	5 (3.1)	18 (6.3)
25 to 54	**Injury**	860 (290.9)	196 (120.4)	759 (265.7)
	Death	49 (16.6)	23 (14.1)	198 (69.3)
55+	**Injury**	313 (105.9)	60 (36.8)	280 (98.0)
	Death	57 (19.3)	32 (19.7)	251 (87.9)

TABLE C5B: NUMBER AND RATE OF CASUALTIES BY IGNITING GROUP, CHILDREN AND YOUTH, CANADA, 2005 TO 2015

		Cooking Equipment	Heating Equipment	Smoker's Material and Open Flame
Total Fires	**N (%)**	**29,567 (19.9%)**	**16,283 (11.0%)**	**28,568 (19.2%)**
0 to 4	**Injury (Rate)**	106 (35.9)	30 (18.4)	56 (19.6)
	Death (Rate)	#	5 (3.1)	19 (6.7)
5 to 9	**Injury**	64 (21.6)	6 (3.7)	48 (16.8)
	Death	0 (0.0)	#	9 (3.2)
10 to 14	**Injury**	45 (15.2)	13 (8.0)	33 (11.6)
	Death	#	0 (0.0)	8 (2.8)
15 to 19	**Injury**	112 (37.9)	13 (8.0)	68 (23.8)
	Death	8 (2.7)	#	14 (4.9)

# denotes cells with more than 0 counts and fewer than 5 counts

TABLE C6: CASUALTIES BY PRESENCE AND ACTIVATION OF SMOKE ALARMS BY PROVINCE, 2005 TO 2015

		Smoke Alarm					
		Present - Activated	Present - Not Activated	Not Present	Unknown/ Missing	N/A	Totals
Total Fires	N	42,761	16,660	29,556	47,024	12,512	148,513
	(%)	(28.8%)	(11.2%)	(19.9%)	(31.7%)	(8.4%)	(100.0%)
	Injury	4,008	1,434	1,354	2,085	532	9,413
	(Rate)	(937.3)	(860.7)	(458.1)	(443.4)	(425.2)	(633.8)
	Death	294	229	359	602	23	1,507
	(Rate)	(72.9)	(120.1)	(121.5)	(128.0)	(18.4)	(101.5)
ON	Fires	26,324	11,299	6,765	22,498	6,142	73,028
		(36.0%)	(15.5%)	(9.3%)	(30.8%)	(8.4%)	(100.0%)
	Injury	2,630	1,140	539	918	507	5,734
		(999.1)	(1,008.9)	(796.7)	(408.0)	(825.5)	(785.2)
	Death	210	134	132	240	7	723
		(79.8)	(118.6)	(195.1)	(106.7)	(11.4)	(99.0)
MB	Fires	4,055	2,518	3,562	4,718	5,657	20,510
		(19.8%)	(12.3%)	(17.4%)	(23.0%)	(27.6%)	(100.0%)
	Injury	11	22	16	24		75
		(0.3)	(0.9)	(0.4)	(0.5)	#	(36.6)
	Death	19	39	47	63		170
		(46.9)	(154.9)	(131.9)	(133.5)	#	(82.9)
SK	Fires	203	60	64	2,594	0	2,921
		(6.9%)	(2.1%)	(2.2%)	(88.8%)	(0.0%)	(100.0%)
	Injury	#	#	#	36	0	44
					(138.8)	(0.0)	(150.6)
	Death	#	0	#	28	0	32
			(0.0)		(107.9)	(0.0)	(109.6)
AB	Fires	3,842	2,518	15,035	3,215	0	24,610
		(15.6%)	(10.2%)	(61.1%)	(13.1%)	(0.0%)	(100.0%)
	Injury	596	271	529	266	0	1,662
		(1,551.3)	(1,076.3)	(351.8)	(827.4)	(0.0)	(675.3)
	Death	42	31	132	59	0	264
		(109.3)	(123.1)	(87.8)	(183.5)	(0.0)	(107.3)
BC	Fires	8,337	0	4,130	13,659	713	26,839
		(31.1%)	(0.0%)	(15.4%)	(50.9%)	(2.7%)	(100.0%)
	Injury	767	0	267	841	23	1,898
		(920.0)	(0.0)	(646.5)	(615.7)	(322.6)	(707.2)
	Death	47	0	45	212	14	318
		(56.4)	(0.0)	(109.0)	(155.2)	(196.4)	(118.5)

# denotes cells with more than 0 counts and fewer than 5 counts

TABLE C7: CASUALTIES BY PRESENCE OF SPRINKLERS BY PROVINCE, 2005 TO 2015

		Sprinkler Protection				
		Yes	No	Unknown/ Missing	N/A	Totals
Total Fires	**N (%)**	**4,248 (2.9%)**	**77,653 (52.3%)**	**54,800 (36.9%)**	**11,812 (8.0%)**	**148,513 (100.0%)**
	Injury (Rate)	**297 (699.2)**	**5,672 (730.4)**	**3,178 (579.9)**	**266 (225.2)**	**9,413 (633.8)**
	Death (Rate)	**14 (33.0)**	**623 (80.2)**	**831 (151.6)**	**39 (33.0)**	**1,507 (101.5)**
ON	**Fires**	**0 (0.0%)**	**31,074 (42.6%)**	**41,954 (57.4%)**	**0 (0.0%)**	**73,028 (100.0%)**
	Injury	0 (0.0)	2,765 (889.8)	2,969 (707.7)	0 (0.0)	5,734 (785.2)
	Death	0 (0.0)	0 (0.0%)	723 (172.3)	0 (0.0)	723 (99.0)
MB	**Fires**	**550 (2.7%)**	**11,818 (57.6%)**	**2,488 (12.1%)**	**5,654 (27.6%)**	**20,510 (100.0%)**
	Injury	0 (0.0)	64 (54.2)	9 (36.2)	#	75 (36.6)
	Death	#	150 (126.9)	16 (64.3)	#	170 (82.9)
SK	**Fires**	**0 (0.0%)**	**0 (0.0%)**	**2,921 (100.0%)**	**0 (0.0%)**	**2,921 (100.0%)**
	Injury	0 (0.0)	0 (0.0)	44 (150.6)	0 (0.0)	44 (150.6)
	Death	0 (0.0)	0 (0.0)	32 (109.6)	0 (0.0)	32 (109.6)
AB	**Fires**	**798 (3.2%)**	**15,534 (62.4%)**	**3,098 (12.5%)**	**5,445 (21.9%)**	**24,875 (100.0%)**
	Injury	97 (1,215.5)	1,287 (828.5)	37 (119.4)	241 (442.6)	1,662 (668.1)
	Death	#	225 (144.8)	12 (38.7)	23 (42.2)	264 (106.1)
BC	**Fires**	**2,900 (10.8%)**	**19,227 (71.6%)**	**3,999 (14.9%)**	**713 (2.7%)**	**26,839 (100.0%)**
	Injury	8 (27.6)	248 (129.0)	48 (120.0)	14 (196.4)	318 (118.5)
	Death	14 (48.3)	623 (324.0)	831 (2,078.0)	39 (547.0)	1,507 (561.5)

# denotes cells with more than 0 counts and fewer than 5 counts

TABLE C8: CASUALTIES BY PRESENCE AND ACTIVATION OF SMOKE ALARMS BY AGE, CANADA 2005 TO 2015

		Smoke Alarm					
		Present - Activated	Present - Not Activated	Not Present	Unknown/ Missing	N/A	Totals
Total Fires	N (%)	42,761 (28.8%)	16,660 (11.2%)	29,556 (19.9%)	47,024 (31.7%)	12,512 (8.4%)	148,513 (100.0%)
All Fires	Injury (Rate)	4,008 (937.3)	1,434 (860.7)	1,354 (458.1)	2,085 (443.4)	532 (425.2)	9,413 (633.8)
	Death (Rate)	294 (72.9)	229 (120.1)	359 (121.5)	602 (128.0)	23 (18.4)	1,507 (101.5)
0 to 19	Injury	374 (87.5)	157 (94.2)	102 (34.5)	266 (56.6)	0 (0.0)	899 (60.5)
	Death	31 (7.2)	33 (19.8)	38 (12.9)	52 (11.1)	#	157 (10.6)
20 to 24	Injury	155 (36.2)	55 (33.0)	70 (23.7)	103 (21.9)	#	384 (25.9)
	Death	8 (1.9)	11 (6.6)	14 (4.7)	32 (6.8)	#	66 (4.4)
25 to 54	Injury	1,248 (291.9)	417 (250.3)	373 (126.2)	1,017 (216.3)	14 (11.2)	3069 (206.6)
	Death	97 (22.7)	72 (43.2)	151 (51.1)	223 (47.4)	7 (5.6)	550 (37.0)
55+	Injury	452 (105.7)	88 (52.8)	116 (39.2)	297 (4.8)	6 (64.6)	959 (64.6)
	Death	182 (42.6)	88 (52.8)	150 (50.8)	257 (54.7)	10 (8.0)	687 (46.3)

# denotes cells with more than 0 counts and fewer than 5 counts

TABLE C9: CASUALTIES BY PRESENCE OF SPRINKLERS BY AGE, CANADA 2005 TO 2015

		Sprinkler Protection				
		Yes	No	Unknown/ Missing	N/A	Totals
Total Fires	N (%)	4,248 (2.9%)	77,653 (52.3%)	54,800 (36.9%)	11,812 (8.0%)	148,513 (100.0%)
All Fires	Injury (Rate)	297 (699.2)	5,672 (730.4)	3,178 (579.9)	266 (225.2)	9,413 (633.8)
	Death (Rate)	14 (33.0)	623 (80.2)	831 (151.6)	39 (33.0)	1,507 (101.5)
0 to 19	Injury	12 (28.2)	319 (41.1)	524 (95.6)	26 (22.0)	881 (59.3)
	Death	0 (0.0)	67 (8.6)	80 (14.6)	#	149 (10.0)
20 to 24	Injury	18 (42.4)	206 (26.5)	131 (23.9)	17 (14.4)	369 (24.8)
	Death	0 (0.0)	32 (4.1)	30 (5.5)	#	63 (4.2)
25 to 54	Injury	90 (211.9)	1,256 (161.7)	1,481 (270.3)	142 (120.2)	2969 (199.9)
	Death	#	233 (30.0)	270 (49.3)	12 (10.2)	518 (34.9)
55+	Injury	50 (117.7)	507 (65.3)	332 (60.6)	36 (30.5)	925 (62.3)
	Death	9 (21.2)	259 (33.4)	392 (71.5)	7 (5.9)	667 (44.9)

# denotes cells with more than 0 counts and fewer than 5 counts

APPENDIX D - DETAILED METHODOLOGY AND RESULTS OF SOCIOECONOMIC STATUS

Methodology

Variable selection:

List of 2011 census variables present in the NFID dataset:

Variable Name	Description
Percent Dwellings	Percentage of dwellings in the selected geography that are single detached dwellings
Lone-parent	Percentage of family dwellings in the selected geography that are single parent families
Average Number	Average number of persons in private households, by selected geography
Percent Residents 1 year	Percentage of residents in selected geography that are high mobility residents (1 year)
Percent Residents 5 years	Percentage of residents in selected geography that are high mobility residents (5 years)
Median Income	Median after-tax income in thousands of dollars, all census families, for selected geography
Employment	Employment rate is the number of employed people as a percentage of the population aged 15 and older
Unemployment	Unemployment rate is the number of unemployed as a percentage of the labour force (employed and unemployed)
Lower Education	Percentage population aged 25 years and older without a certificate, diploma or degree

From these census variables, lone-parent, median income, and lower education were chosen as our surrogate measures for socioeconomic status (SES).

CSD vs CMA:

Census data was presented at the CMA/CA and CSD levels. Although using more granular separations are generally preferred, aggregation at the CSD level resulted in 75% of CSD regions with fewer than 50 fire incidents across the 10-year span, whereas only 2% of CMA/CA regions had fewer than 50 fire incidents. With the low rates of residential fire casualties per fire incidents reported, we decided to use the SES values and aggregate our counts at the CMA/CA level.

One region (Wood Buffalo, Alberta) had a reported after-tax median household income of nearly $180,000, which is over six standard deviations away from the mean of all the regions, thus this region was excluded from the analysis. This resulted in 90 CMA/CA regions across four provinces (BC, AB, MN, ON) being included in the analysis.

Outcome Variables:

Number of fire incidents per CMA/CA was calculated by adding up the number of unique link identification numbers. Number of deaths per CMA/CA was calculated by adding up the number of victims that were classified with death in the nature of casualties variable. Number of injuries per CMA/CA was calculated by adding up the number of victims that were classified with minor, light, serious or seriousness unknown injuries in the nature of casualties variable.

Number of casualties per CMA/CA was the summation of the deaths and injuries for that CMA/CA. Due to the low number of deaths and injuries for some of the regions, we chose to use the number of casualties as the outcome variable of interest. This was computed for three populations of interest: whole population, children and youth (0-19), and adults (25+).

Data Analysis:

For each population group, we applied a Poisson regression model with the number casualties as the outcome variable of interest, the three SES variables (lone-parent, median income, lower education) as our predictors, with province as a categorical covariate (British Columbia was used as the reference group), and offset by the total number of fire incidents.

This allowed us test the associations between the SES variables and the rate of casualties (deaths + injuries) from residential fires, while controlling for the province and number of fire incidents overall.

All analyses were conducted using SAS 9.4.

Results:

Whole Population

TABLE D1: POISSON REGRESSION MODEL OF CASUALTY RATE (0 TO 100 YEARS)

Whole Population		
Variable	Rate Ratio (95% CI)	p-value
Lone-Parent*	1.022 (1.011 - 1.033)	0.0001
Median Income*	0.993 (0.988 - 0.998)	0.0040
Lower Education*	0.974 (0.965 - 0.983)	0.0001
ON*	1.286 (1.205 - 1.371)	0.0001
MB*	0.0913 (0.075 - 0.111)	0.0001
AB*	1.154 (1.035 - 0.287)	0.0100

Note: *Significant results at $p<0.05$; BC was the reference jurisdiction

All the SES variables were significantly associated with the casualty rate. For each percent increase in single parent dwellings in the region, the casualty rate due to residential fires increases by 2.2%. For each $1000 increase in median household income, the casualty rate decreases by 0.7%. For each percent increase in proportion of adult population without a certificate, diploma, or degree, the casualty rate decreases by 2.6%.

Children and Youth

TABLE D2: POISSON REGRESSION MODEL OF CASUALTY RATE (0 TO 100 YEARS)

Children and Youth		
Variable	Rate Ratio (95% CI)	p-value
Lone-Parent*	1.074 (1.036 - 1.114)	0.0001
Median Income	1.003 (0.987 - 1.018)	0.7587
Lower Education	0.980 (0.951 - 1.011)	0.2053
ON*	1.534 (1.229 - 1.915)	0.0002
MB*	0.072 (0.033 - 0.155)	0.0001
AB*	1.753 (1.230 - 2.498)	0.0019

Note: *Significant results at p<0.05; BC was the reference jurisdiction

Only lone-parent was significantly associated with casualty rate. For each percent increase in single parent dwellings in the region, the casualty rate due to residential fires increases by 7.4%.

Adults

TABLE D3: POISSON REGRESSION MODEL OF CASUALTY RATE (20 TO 100 YEARS)

Adults		
Variable	Rate Ratio (95% CI)	p-value
Lone-Parent*	1.029 (1.016 - 1.043)	0.0001
Median Income	0.995 (0.989 - 1.000)	0.0633
Lower Education*	0.975 (0.965 - 0.986)	0.0001
ON*	1.957 (1.809 - 2.117)	0.0001
MB*	0.136 (0.110 - 0.168)	0.0001
AB*	1.414 (1.244 - 1.607)	0.0001

Note: *Significant results at p<0.05; BC was the reference jurisdiction

Lone-parent and lower education were significantly associated with casualty rate, while median income only showed a trend. For each percent increase in single parent dwellings in the region, the

casualty rate due to residential fires increases by 2.9%. For each $1000 increase in median household income, the casualty rate decreases by 0.5%. For each percent increase in proportion of adult population without a certificate, diploma, or degree, the casualty rate decreases by 2.5%.

UNIVERSITY OF THE FRASER VALLEY
CENTRE FOR PUBLIC SAFETY & CRIMINAL JUSTICE RESEARCH

BC INJURY research and prevention unit