



Firefighter Occupational Injuries and Fatalities

Analysis of Accepted Claims, 2007 - 2021

MARCH 2024

BC INJURY research and prevention unit

The British Columbia Injury Research and Prevention Unit (BCIRPU) was established by the Ministry of Health and the Minister's Injury Prevention Advisory Committee in August 1997. BCIRPU is housed within the Evidence to Innovation research theme at BC Children's Hospital (BCCH) and supported by the Provincial Health Services Authority (PHSA) and the University of British Columbia (UBC). BCIRPU's vision is *to be a leader in the production and transfer of injury prevention knowledge and the integration of evidence-based injury prevention practices into the daily lives of those at risk, those who care for them, and those with a mandate for public health and safety in British Columbia.*

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Suggested Citation:

AlHajj S, Thomas L, Garis L, Pike I. (2024). Firefighter Occupational Injuries and Fatalities: Analysis of Accepted Claims, 2007 – 2021. A report prepared by the BC Injury Research and Prevention Unit. Vancouver, BC, Canada.

PREFACE

A previous Canadian study using data from the Association of Worker's Compensation Boards of Canada (AWCBC) and WorkSafeBC covering the years 2006 to 2018, revealed that the most prominent causes of injuries and fatalities among firefighters were cancer, traumatic injuries, circulatory and respiratory system diseases, and mental disorders [1]. Of these, cancer and traumatic injuries were by far the leading cause of fatalities among firefighters, with cancer claiming nearly 90% of firefighter fatalities. The study also underscored an increasing and concerning rate of mental disorder among firefighters in the years reported, which had a major impact on time-loss and productivity.

This report is an update to the original report, *Trend analysis of Association of Workers Compensation Boards of Canada fatality and injury claims among Firefighters, 2006–2018* [1], and provides an update and further understanding of the trends and patterns of injuries and fatalities among firefighters, using time series data from 2007 to 2021, inclusive.

ACKNOWLEDGEMENTS

The authors wish to thank the Association of Workers' Compensation Boards of Canada for providing the data necessary to complete this study.

This study arises from the concern for individuals, men and women, who have suffered from injuries or lost their lives due to their work as Firefighters. It is our hope that this work will help to influence and improve a culture of safety¹ within the firefighting profession and to inform the needs for targeted preventative programs.

LIST OF ABBREVIATIONS

AWCBC	Association of Worker's Compensation Boards of Canada
CVD	Cardiovascular Disease
PTSD	Post Traumatic Stress Disorder
USA	United States of America

¹ Refer to Appendix C for links to resources providing additional insights to improving the culture of safety for firefighters.

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EXECUTIVE SUMMARY

- Occupational injuries and deaths impose a substantial threat to the health and wellbeing of firefighters globally. Firefighters reported high rates of morbidity and mortality, surpassing other occupations [1-3].
- The primary objective of this study was to expand the initial Firefighter Fatality and Injury study (2006-2018) and to evaluate the trends and patterns in fatality and time loss injury claims over a period of 15 years (2007-2021). It further aimed to identify the leading causes of fatalities and injuries among firefighters across Canada.
- Time series data retrieved from the Association of Worker's Compensation Boards of Canada (AWCBC) and WorkSafeBC were analyzed to assess morbidity and mortality among firefighters.
- Findings from this study revealed that cancer remained the main contributing factor to firefighters' mortality. A substantial increase in mental health related injuries were reported, particularly among firefighters aged 40 to 54.
- Cancer was the leading cause of fatality claims among firefighters, comprising 84.6% of claims, corresponding to a fatality rate of 993.7 per 100,000 firefighters. The category of "Malignant neoplasms and tumors (cancers, carcinomas, sarcomas)" dominated firefighter fatality claims from cancer for the period from 2007 to 2021. Claims for this category showed an upward trend, starting from 53 in 2007 and peaking at 126 in 2020, with a slight decrease to 94 in 2021.
- Traumatic injury was the second most common cause of fatality, with 6.5% of claims and a rate of 76.0 fatalities per 100,000.
- Cardiovascular system diseases were responsible for 4.2% of fatality claims, with a rate of 49.9 fatalities per 100,000.
- The data from 2007 to 2021 revealed that the age group 65 and over reported the highest number of fatality claims with 826 deaths, representing 54.7% of all deaths.
- Ontario, the most populous province, led in fatality claims with a total of 654. This is nearly four times as many as the 165 claims recorded in Alberta; the second-highest count. British Columbia followed closely with 135 claims, while Quebec had the fewest at 108, bringing the collective total to 1,062 fatality claims across these regions.
- Traumatic injury represented the majority of time-loss claims for Canadian firefighters between 2007-2021, accounting for 80.57% of claims with a rate of 17,859.1 per 100,000 firefighters.
- Mental health-related claims represented 5.91% of time-loss claims, with a rate of 1,309.6 per 100,000 firefighters.
- The data revealed that the age group with the highest number of mental health-related injury claims was the 45-49 bracket, with 285 claims. This was closely followed by the 40-44 and 50-54 age groups, with 276 and 267 claims, respectively.
- From 2007 to 2021, there was a substantial increase in mental health-related injury claims among Canadian firefighters. Starting in 2011, there was a more noticeable upward trend in all provinces. This trend became significantly steeper around 2016, with Ontario showing a particularly sharp rise. By 2021, all provinces had a much higher sum of mental health cases compared to 2007, with Ontario having the highest at 188 cases, Alberta next at 106, followed by British Columbia with 56, and Quebec with 32

INTRODUCTION AND BACKGROUND

Occupational injuries and deaths impose a significant threat to the health and wellbeing of firefighters globally, with reported high rates of morbidity and mortality, surpassing other occupations [1-3]. Canada recorded nearly 3,570 on-duty firefighter injuries and 2 fatalities in 2022, while the USA reported 65,650 injuries and 96 fatalities in the same year [4, 5]. Despite receiving rigorous training and the use of personal protective equipment (PPE), The risk of occupational injuries among firefighters, particularly i when actively fighting fires remains substantial [4, 6]. The direct exposure to toxins resulting from fire and explosive hazards, coupled with physical strains from lifting heavy equipment and working on slippery and fall hazardous surfaces exacerbate firefighters' susceptibility to various diseases and injuries, including respiratory system disease and musculoskeletal injuries [7-12], especially among older, obese, and inactive firefighters [4, 13-17]. Globally, the predominant causes of injuries and fatalities among firefighters are overexertion, falls, slips and trips [4, 18-20], with sprains and strains to the back and extremities being the most commonly reported injuries [4, 10, 16, 19, 21].

Risk factors such as long duty shifts, fatigue, sleep disorders and low levels of fitness all contribute to the increased prevalence of injuries [4, 13, 16, 22]. Existing studies associated these sustained injuries with chronic pain and inflammation leading to deteriorating firefighters' musculoskeletal health. Prolonged fire-hour exposure to toxins and toxic agents negatively impacts the overall health of firefighters and increase their long-term susceptibility to diseases such as cancer and cardiovascular disease (CVD) [23-29]. Consistent chronic stress and sleep disorders among firefighters heightened their risk of mental disorders. Previous studies underscore the significantly high rates of firefighters suffering from mental disorders compared to the general public, including anxiety, depression, sleep deprivation, burnout, alcohol abuse, post-traumatic stress disorder (PTSD) and suicide [30-35].

A previous study conducted in Canada [2006-2018], using data from the Association of Worker's Compensation Boards of Canada (AWCBC) and WorkSafeBC, revealed that the most prominent mechanisms of injuries and fatalities among firefighters were cancer, traumatic injuries, circulatory system, respiratory system, and mental disorder [1]. Cancer and traumatic injuries constituted the leading cause of fatalities among firefighters, with cancer claiming nearly 90% of firefighters' fatalities. The study further underscored the increasing rate of mental disorder among firefighters in the years reported, which had a major impact on time-loss and productivity.

PURPOSE OF THIS RESEARCH

This study builds upon the previous study that examined firefighters accepted fatalities and time-loss claims data between 2006 and 2018, and which reported on the prevalence of morbidity and mortality associated with cancer, traumatic injuries, and mental disorder among firefighters. The primary purpose of this study is to provide a comparison with firefighters' mortality and morbidity data from 2006-2018 and to offer in-depth understanding of the trends and patterns of injuries and fatalities among firefighters using time series data from 2007 to 2021, inclusive.

METHODOLOGY

Data on fatality and time-loss injury were retrieved for accepted claims from 2 sources: The Association of Workers' Compensation Boards of Canada (AWCBC) and WorkSafeBC, which allowed for additional provincial data from British Columbia (BC). The compiled dataset encompasses national data from the twelve provinces and territories across Canada. Data from the Northwest Territories and Nunavut were combined into one dataset.

The fatality and time-loss claims refer only to accepted claims submitted by firefighters and not all claims related to injuries or fatalities occurring at the workplace. Claims data include firefighter demographic information (age and gender), claim type (fatality, time loss), claim source location (province), claim year, injury event, nature of injury, and body part injured. Data correspond to 15 years of data spanning the time period from 2007 to 2021, inclusive, and consisted of three cohorts covering different time periods: 2007-2017, 2007-2018, and 2018-2021.

Fatalities and time-loss claims were compiled into datasets and prepared for analysis. To establish coherence between the datasets, we adopted the nature of injury classification to categorize fatalities and injuries and facilitate comparison. For the 2018 to 2021 cohort, the nature of injury subcategories were aggregated into one main category based on the first two digits in their coding, which indicated the main injury category (Appendix A). To protect the privacy of individual claimants and avoid personal identifications, all cells with fewer than three cases were replaced with x in the database. All x values were then randomly assigned values 1, 2 or 3 to avoid the analytical concerns of dealing with missing data (Appendix B).

The datasets were merged into one larger dataset in order to analyze the time-related trend of accepted fatality and injury claims, removing any and all duplicates for the year 2018. The data was aggregated by province, year, age or nature of injury, and exported to excel to create graphs illustrating the trends. Descriptive analyses were conducted on the fatality and time-loss claims data. The statistics include data from several Canadian provinces and territories (AB, BC, MB, NB, NS, ON, QC, SK, YU only).

RESULTS

OVERVIEW

A total of 29,499 claims (fatality N= 1,509 and time-loss N = 27,990) were included in this study (Table 1). The data show a predominance of males submitted claims over females (fatalities 99.4% and the time-loss 92.24 %). The majority of fatality claims were presented by the age group 65 and over (N= 826, 54.74%), whereas most time loss claims were presented by the 40-44 age group (N= 4,513, 16.12%), followed closely by the two age groups 45-49 (N= 4,418, 15.78%) and 35-39 (N= 4,388, 15.68%). The geographic distribution of claims varied across Canadian provinces indicating a clear disparity as Ontario reported the highest number of fatality (N= 713, 47.25 %) and time-loss claims (N=8591, 30.69%) with other provinces, including Quebec, British Columbia, and Alberta, reporting relatively high fatality and time-loss claims.

TABLE 1: CANADIAN FIREFIGHTER FATALITY AND TIME-LOSS CLAIMS (2007 – 2021)

Variable	Injury claims		Fatality claims	
	N	Percentage	N	Percentage
	27,990		1,509	
Age				
<i>15-19</i>	222	0.79	3	0.20
<i>20-24</i>	1,273	4.55	1	0.07
<i>25-29</i>	2,626	9.38	14	0.93
<i>30-34</i>	3,954	14.13	9	0.60
<i>35-39</i>	4,388	15.68	10	0.66
<i>40-44</i>	4,513	16.12	42	2.78
<i>45-49</i>	4,418	15.78	81	5.37
<i>50-54</i>	3,489	12.47	155	10.27
<i>55-59</i>	2,129	7.61	158	10.47
<i>60-64</i>	544	1.94	210	13.92
<i>65 and over</i>	425	1.52	826	54.74
<i>unknown</i>	9	0.03	-	
Gender				
<i>Male</i>	25,819	92.24	1,500	99.40
<i>Female</i>	2,141	7.65	9	0.60
<i>unknown</i>	30	0.11	-	-
Province				
<i>Alberta</i>	4,457	15.92	221	14.65
<i>British Columbia</i>	4,935	17.63	180	11.93
<i>Manitoba</i>	2,292	8.19	88	5.83
<i>New Brunswick</i>	741	2.65	35	2.32
<i>Newfoundland and Labrador</i>	205	0.73	25	1.66
<i>Northwest Territories and Nunavut</i>	158	0.56	1	0.07
<i>Nova Scotia</i>	342	1.22	32	2.12
<i>Ontario</i>	8,591	30.69	713	47.25
<i>Prince Edward Island</i>	60	0.21		
<i>Quebec</i>	5,283	18.87	136	9.01
<i>Saskatchewan</i>	843	3.01	76	5.04
<i>Yukon</i>	83	0.30	2	0.13

FIREFIGHTER FATALITIES

AGE-GROUP DISTRIBUTION OF FATALITIES

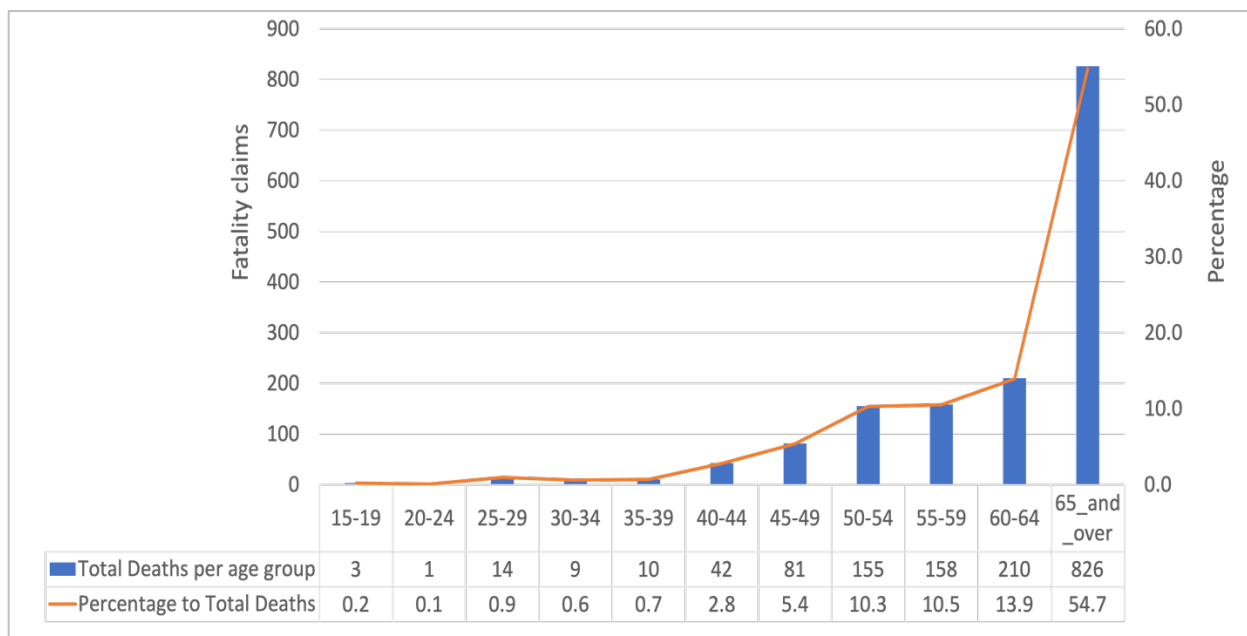
Firefighters’ fatalities were distributed across age groups ranging from 15 to 65 years and above. The fatality data reveal that the age group, 65 and over reported the highest number of fatality claims with 826 deaths, representing 54.7% of all deaths (Table 2). The least impacted age groups were 15-19 and 20-24, with 3 and 1 death(s) respectively; negligible proportions of the total.

Table 2: CANADIAN FIREFIGHTER FATALITY CLAIMS BY AGE GROUPS (2007 – 2021)

Age Groups	Fatalities	Fatalities - %of Claims
15-19	3	0.2
20-24	1	0.1
25-29	14	0.9
30-34	9	0.6
35-39	10	0.7
40-44	42	2.8
45-49	81	5.4
50-54	155	10.3
55-59	158	10.5
60-64	210	13.9
65 plus	826	54.7

A clear trend of increasing fatality claims with increasing age was reported among Canadian firefighters from 2007 to 2021 (Graph 1). The pattern indicates a clear correlation of fatality claims with age among Canadian firefighters.

GRAPH 1: CANADIAN FIREFIGHTER FATALITY CLAIMS BY AGE GROUP FOR ALL COHORTS (2007 – 2021)



CAUSES OF FATALITY

In Canada, firefighters’ fatalities are attributed to numerous causes including cancer, traumatic injuries, cardiovascular disease, respiratory system and nervous system diseases as well as mental health disorders. As depicted in Table 3, this study reveals that cancer was the leading cause of fatality claims among firefighters from 2007 to 2021, comprising 84.6% of claims and corresponding to a fatality rate of 993.7 per 100,000 firefighters. Traumatic injuries were the second leading cause of fatality claims, representing 6.5% of claims with a fatality rate of 76.0 per 100,000. Cardiovascular system diseases caused 4.2% of the fatality claims, with a rate of 49.9 per 100,000, while respiratory system diseases accounted for 2.6% of claims and a rate of 30.9 per 100,000. Mental health-related claims were relatively low, accounting for 0.7% of claims with fatality rates of 8.7 per 100,00.

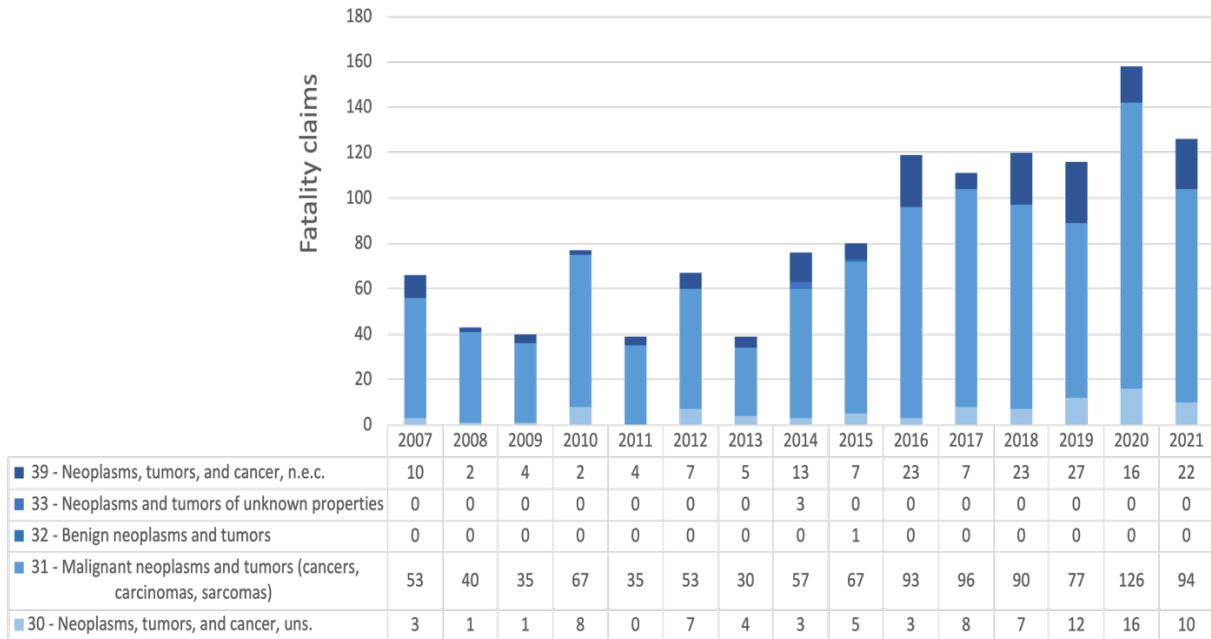
TABLE 3: CANADIAN FIREFIGHTER FATALITY CLAIMS BY NATURE OF INJURY

Nature of Injury	Fatalities - % of claims*	Fatalities - Rate per 100,000 FF*
Cancer	84.6%	993.7
Traumatic Injury	6.5%	76.0
Cardiovascular disease	4.2%	49.9
Respiratory system disease	2.6%	30.9
Nervous system diseases	0.6%	7.1
Mental disorder	0.7%	8.7
Unknown	0.3%	3.2
Infectious, bacterial, viral, parasitic diseases	0.1%	1.6
<i>*includes AB, BC,MB,NB,NS,ON,QC,SK,YU only</i>		

CANCER RELATED FATALITIES

Overall, there was a noticeable upward trend in the total number of fatalities claims due to cancer among Canadian firefighters from 2007 to 2021, with total claims reaching their highest at 160 in 2020. Cancer remained the leading contributing factor and the foremost cause of deaths within the firefighter community. The category "Malignant neoplasms and tumors (cancers, carcinomas, sarcomas)" was the leading cause of cancer-related fatality claims among Canadian firefighters, showing an increase from 53 claims in 2007 to a peak of 126 in 2020, before a decrease to 94 in 2021 (Graph 2). Other categories of cancer including "Neoplasms, tumors, and cancer, unspecified" remained relatively low, with no more than 8 claims in any given year. No claims were recorded under "Benign neoplasms and tumors" or "Neoplasms and tumors of unknown properties" throughout the study period.

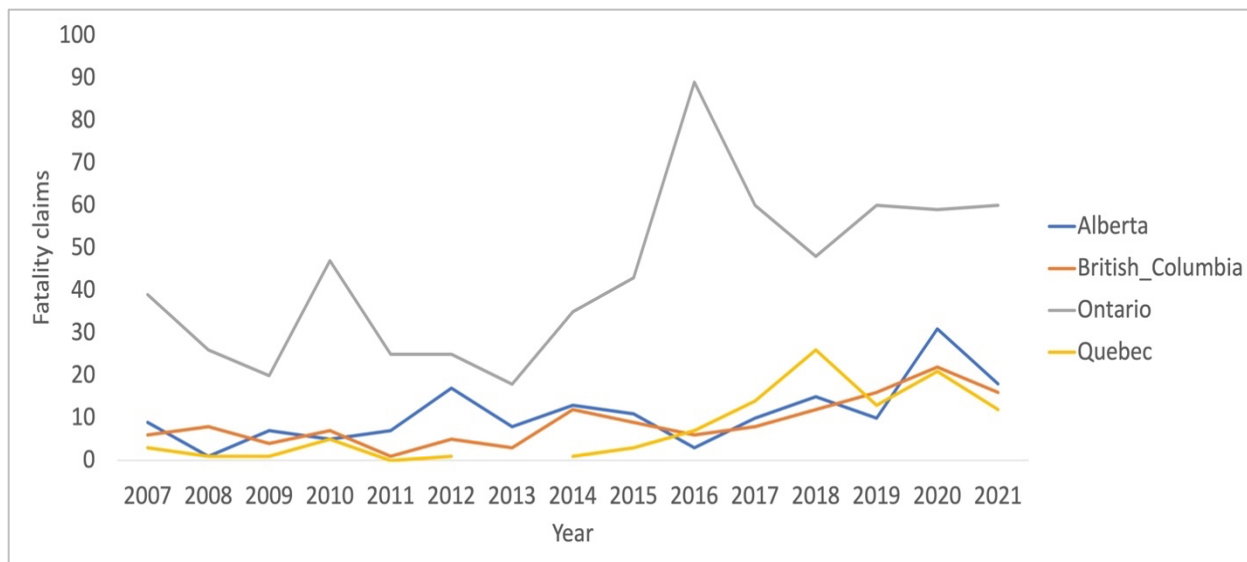
GRAPH 2: FIREFIGHTER FATALITY CLAIMS FROM CANCER IN CANADA: 2007 – 2021



As illustrated in Graph 3, over the span of 15 years (2007 – 2021), the distribution of firefighter fatality claims across various Canadian provinces presents a heterogeneous picture, indicating fluctuating patterns rather than a steady trend. Ontario, the most populous province, led in fatality claims with a significant total of 654. This is nearly four times as many as the 165 claims recorded in Alberta, which accounted for the second-highest count. British Columbia followed closely with 135 claims, while Quebec had the fewest at 108, bringing the collective total to 1,062 across these regions.

Throughout this period, the data exhibited notable fluctuations rather than a consistent trend. A particularly sharp increase was observed in Ontario's claims in 2017, reaching a peak with 89 claims, which is an unusually high count compared to the other years in that province. Meanwhile, Alberta's claims peaked in 2020 with 31 claims, and British Columbia saw its highest number of claims at the outset of the period in 2007 with 39 claims. Quebec, on the other hand, demonstrated a consistent pattern, with the number of claims remaining relatively stable over time.

GRAPH 3: FIREFIGHTER FATALITY CLAIMS FROM CANCER IN CANADA BY PROVINCES: 2007 – 2021



FIREFIGHTER TIME-LOSS INJURY CLAIMS

TIME-LOSS AGE-GROUP AND LOCATION DISTRIBUTION

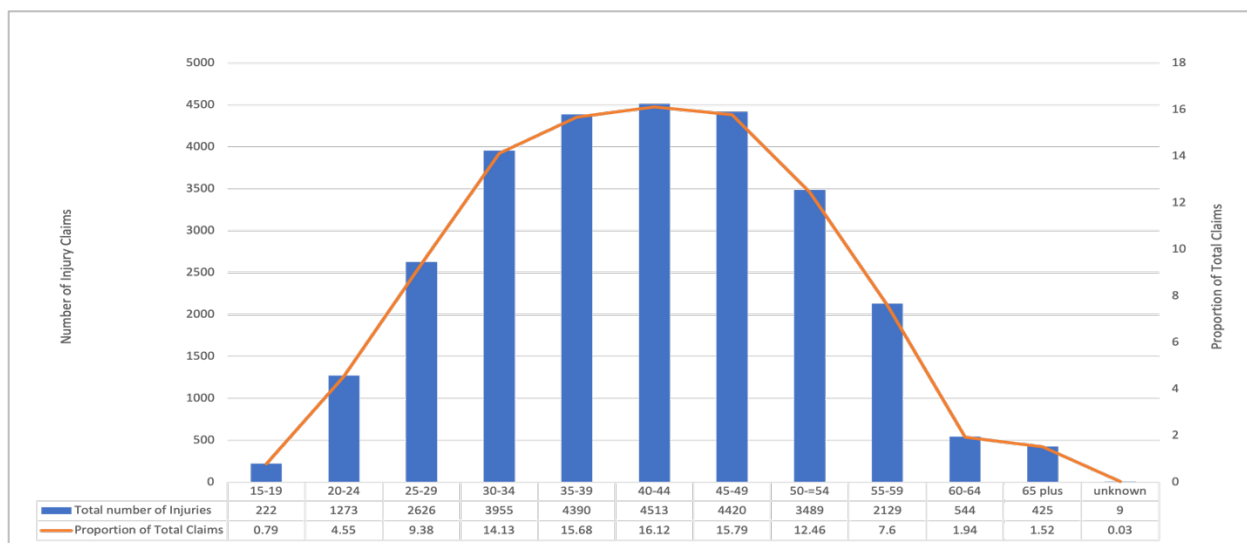
Firefighters time loss injury claims were distributed among age groups ranging from 15 to 65 years and over. The majority of the reported injuries were sustained by firefighters aged between 30 and 54 years (Table 4).

TABLE 4: CANADIAN FIREFIGHTER TIME LOSS CLAIMS BY AGE GROUPS (2006-2018)

Age Groups	Time-Loss	Time-Loss - %of Claims
15-19	222	0.79
20-24	1,273	4.55
25-29	2,626	9.38
30-34	3955	14.13
35-39	4390	15.68
40-44	4513	16.12
45-49	4420	15.79
50-54	3489	12.46
55-59	2129	7.60
60-64	544	1.94
65 and over	425	1.52
Unknown	9	0.03

The percentage of total time loss claims showed a bell-shaped curve (Graph 4), with a peak in the mid-life age groups and a decrease in both the younger and older ages. The age group with the highest number of injury claims among Canadian firefighters was 40-44 years, with a total of 4,513 claims, making up 16.12% of all claims from 2007 to 2021. The second highest was the 45-49 age group, with 4,420 claims, representing 15.79% of the total claims.

GRAPH 4: CANADIAN FIREFIGHTER INJURY CLAIMS BY AGE GROUPS (2007-2021)



Time-loss claims data were distributed across all Canadian provinces and spanned from 2007 to 2021, with high claims reported mainly in four provinces: Alberta, British Columbia, Ontario, and Quebec (Table 5).

TABLE 5: CANADIAN FIREFIGHTER TIME LOSS CLAIMS BY LOCATION PROVINCES (2007-2021)

PROVINCES	Traumatic Injuries	Nervous	CVD	Respiratory	Digestive	Musculo skeletal	Skin	Cancer	other	Mental Health	Unknown	Infectious
Alberta	3493	9	16	224	40	39	8	162	57	390	6	17
British Columbia	4033	36	83	102	87	81	9	129	72	273	0	30
Manitoba	1914	51	19	17	37	56	8	47	45	86	6	7
New Brunswick	572	21	30	3	20	3	0	20	8	53	0	11
Newfoundland and Labrador	193	4	3	0	0	0	0	1	0	4	0	0
Northwest Territories & Nunavut	129	6	0	1	0	10	6	0	5	1	0	0
Nova Scotia	273	2	4	2	6	19	0	14	1	17	4	0
Ontario	6918	46	64	222	101	139	69	267	92	631	6	36
Prince Edward Island	43	4	0	0	3	0	0	0	3	7	0	0
Quebec	4270	211	12	82	30	292	23	32	96	149	68	17
Saskatchewan	660	15	4	15	1	10	3	33	15	35	49	3
Yukon	58	5	2	0	0	2	0	6	2	8	0	0
Total	22556	410	237	668	325	651	126	711	396	1654	139	121
Percentage	80.57	1.46	0.85	2.39	1.16	2.33	0.45	2.54	1.41	5.91	0.50	0.43

CAUSES OF TIME-LOSS

Between 2007 and 2021, Canadian firefighters' time-loss claims were predominantly due to traumatic injuries, which made up over 80% of claims at a rate of 17,859.1 per 100,000 firefighters (Table 6). Mental health-related issues were significant, accounting for nearly 6% of claims. Cancer-related time-loss was lower, representing 2.54% of claims. Diseases of the respiratory system made up 2.39% of claims, followed closely by musculoskeletal and connective tissue diseases at 2.33%. Nervous system and sensory organ-related diseases constituted 1.46% of claims.

Other unspecified conditions were responsible for 1.41% of claims. Digestive system diseases and circulatory system diseases were less common, accounting for 1.16% and 0.85% of claims, respectively.

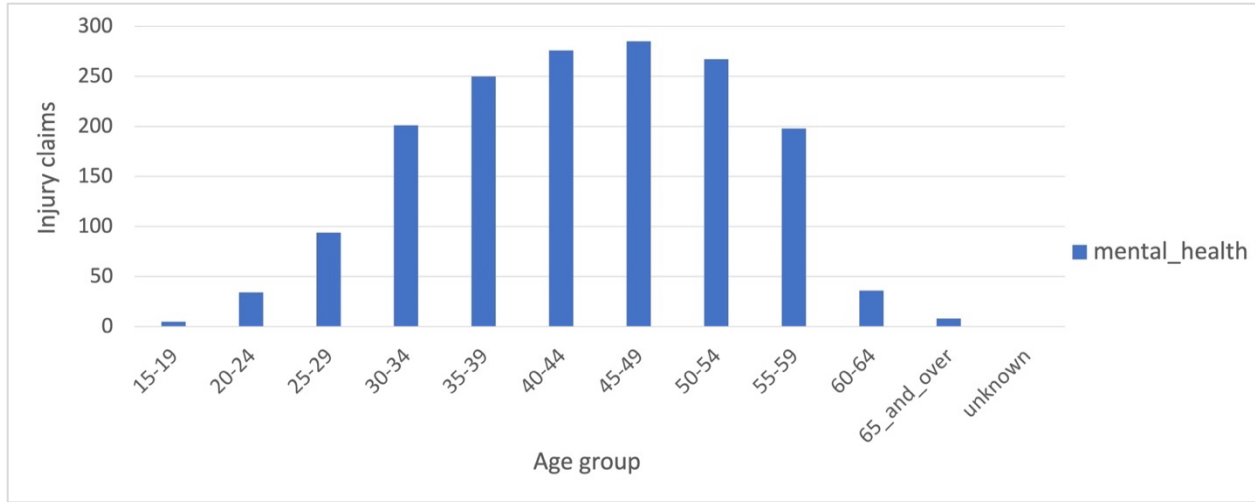
TABLE 6: CANADIAN FIREFIGHTER TIME LOSS CLAIMS BY NATURE OF INJURY

Nature of Injury	Time Loss Claims - % of claims*	Time Loss Claims - Rate per 100,000 FF*
Traumatic injury	80.57%	17859.1
Mental health	5.91%	1309.6
Cancers	2.54%	562.9
Respiratory system diseases	2.39%	528.9
Musculoskeletal system and connective tissue diseases	2.33%	515.4
Nervous system and sense organs diseases	1.46%	324.6
Other	1.41%	313.5
Digestive system diseases and disorders	1.16%	257.3
Circulatory system diseases	0.85%	187.6
Unknown	0.50%	110.1
Skin and subcutaneous tissue diseases	0.45%	99.8
Infectious, bacterial, viral, parasitic diseases	0.43%	95.8
Genitourinary system diseases and disorders	0.004%	0.8

TIME-LOSS DUE TO MENTAL HEALTH CLAIMS

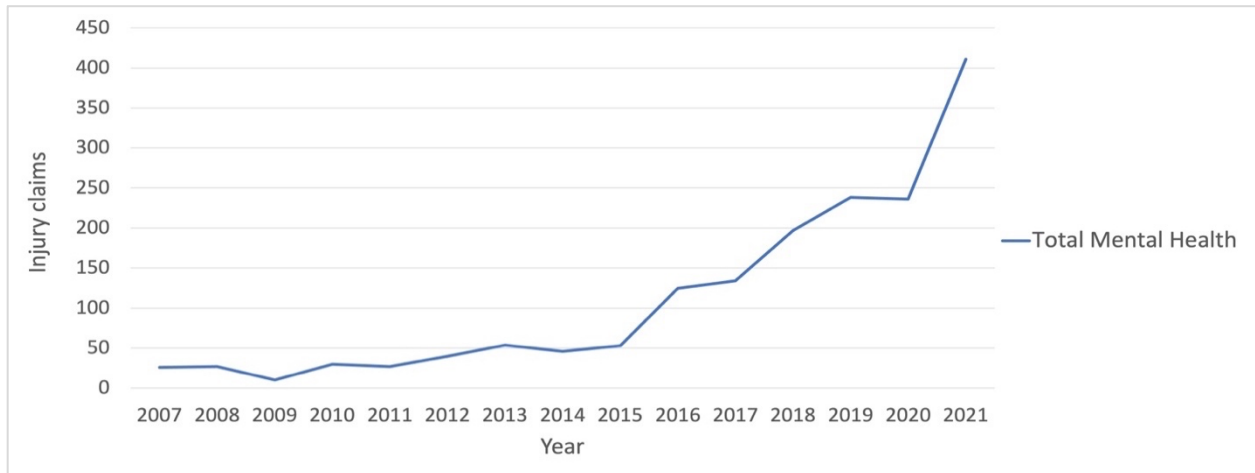
Overall, mental health time-loss claims displayed an increasing trend over time from 2007 to 2021. There was a total of 1,654 mental health-related injury claims, across the 15-year period. Graph 5 shows a mid-life peak in claims, with a subsequent decline in older age groups. The time loss data revealed that the age group with the highest number of mental health-related injury claims was the 45-49 bracket, with 285 claims. This was closely followed by the 40-44 and 50-54 age groups, with 276 and 267 claims respectively, reflecting a plausible combination of reduced workforce numbers in those age brackets and potentially different coping mechanisms or support systems as firefighters age. The claims then decreased slightly in the next age group, 55-59, which reported 198 claims. The youngest age group, 15-19, had the fewest claims at 5.

GRAPH 5: FIREFIGHTER INJURY CLAIMS FROM MENTAL DISORDER IN CANADA BY AGE GROUPS (2007-2021)



Graph 6 illustrates a steep upward trajectory over the 15-year period in overall reported mental disorders during study. From the initial years (2007-2010), the number of mental health cases reported in each province was relatively low and increased only slightly. In 2007, the number of time loss claims of mental disorder were initially 26 claims, that incrementally and gradually increased each year, reaching 30 by 2010. The year-on-year growth continued moderately, registering 46 in 2014 and 53 in 2015. Starting in 2015, there was a significant rise in mental health claims by Canadian firefighters in the latter part of the study period (2015-2021). A more significant rise began in 2016, with the number of claims reaching 125, followed by a substantial leap to 134 in 2017. This ascending trend persisted, with claims increasing to 197 in 2018 and jumping further to 238 in 2019. There was a slight decrease in 2020 with 236 claims, which was immediately followed by a dramatic surge to 411 claims in 2021.

GRAPH 6: CANADIAN FIREFIGHTER INJURY CLAIMS OF MENTAL DISORDER



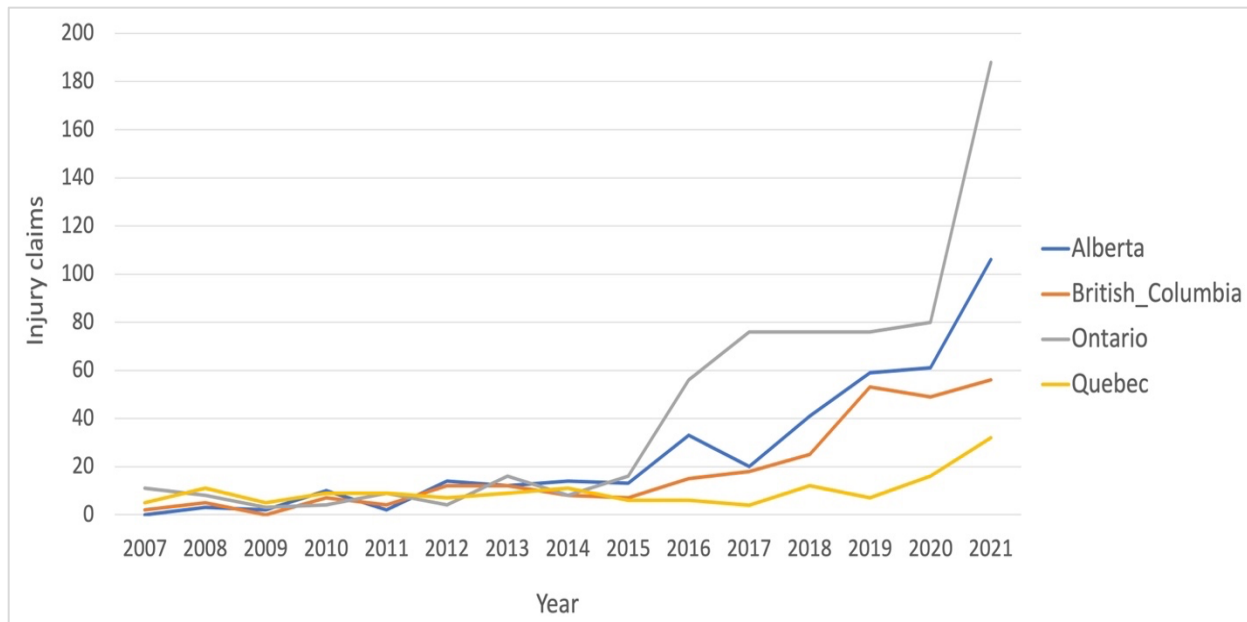
Over the last 15 years, analysis of the mental health disorder claims revealed that the majority of the claims were submitted by four provinces: Alberta, British Columbia, Ontario and Quebec (Table 7). Provinces started with low case counts and increased significantly over time. By 2021, all provinces had a much higher total number of mental health cases compared to 2007, with Ontario having the highest at 188 cases, Alberta next at 106, followed by British Columbia with 56, and Quebec with 32.

TABLE 7: CANADIAN FIREFIGHTER TIME LOSS CLAIMS OF MENTAL DISORDER BY LOCATION - TOP 4 PROVINCES (2007-2021)

Years	PROVINCES				Grand Total
	Alberta	British Columbia	Ontario	Quebec	
2007	0	2	11	5	18
2008	3	5	8	11	27
2009	2	0	3	5	10
2010	10	7	4	9	30
2011	2	4	9	9	24
2012	14	12	4	7	37
2013	12	12	16	9	49
2014	14	8	8	11	41
2015	13	7	16	6	42
2016	33	15	56	6	110
2017	20	18	76	4	118
2018	41	25	76	12	154
2019	59	53	76	7	195
2020	61	49	80	16	206
2021	106	56	188	32	382
Grand Total	390	273	631	149	1443

Alberta and Quebec showed lower upward trajectory trends compared to British Columbia and Ontario (Graph 7). However, starting from 2011, there was a more noticeable upward trend in all provinces. This trend became significantly steeper around 2016, with Ontario showing a particularly sharp rise. The total sum of cases across these provinces increased from 18 cases in 2007 to 382 cases in 2021, indicating a substantial increase in reported mental health cases over the 15-year period.

GRAPH 7: CANADIAN FIREFIGHTER INJURY CLAIMS OF MENTAL DISORDER (TOP 4 PROVINCES)



CONCLUSION

This study analyzed fatalities and time-loss injury data and revealed the high burden of morbidity and mortality among firefighters in Canada. Findings on fatalities and injuries associated with the occupation of firefighting uncover strong evidence of increased risk associated with the exposure to fireground released toxic contaminants and hazardous work environments, and their short term (i.e., traumatic injuries) and long term (i.e., cancer, mental disorder) repercussions and health risks.

Synthesized evidence from this study confirms previous findings and underscores the heightened health risks associated with the firefighting occupation [1-3]. The study results are consistent with findings from existing literature on the increased morbidity and mortality related to the high prevalence of cancer, traumatic injuries, and mental health disorder among firefighters [30-47]. Cancer and mental health disorder remained the leading causes and the major contributors to the high mortality rates among members of the firefighter community. Traumatic injury constitutes the leading cause of injuries and the second leading cause for deaths among firefighters. The age groups most impacted by fatalities comprises individuals aged 65 and above whereas the highest number of mental health-related injury claims was recorded among those aged 45-49.

Aligned with existing literature [36-43], this study underscores cancer as the primary cause of mortality among firefighters, comprising a substantial 84.6% of claims, a rate consistent with earlier reports [1, 5] and above the 43% rate reported in the general population [5]. Notably, our investigation pinpoints a spectrum of cancers to which firefighters are vulnerable, shedding light on the multifaceted nature of their occupational hazards. Compared to the previous study (2006-2015), this study revealed a slight decrease, though high rates of cancer fatality claims from 86.1% (2006-2021) to 84.6% (2006-2021), whereas an increase from 1.5% to 2.5% in the time-loss injury claims related to cancer was reported for the same period of time. Previous studies have attributed heightened cancer risk among firefighters to various occupational factors, including prolonged exposure to heat, chemicals, and stress, among other factors [36, 37, 41, 42, 48, 49].

Compared to the previous report (2006-2018), this study provided evidence of the noticeable increase in mental health disorder incidence among firefighters. The reported mental health claims experienced the most dramatic rate increase among the various claim types when comparing the 2019 – 2021 data to the original 2006 – 2018 data. The change from 3.59% of time-loss injury claims to 11.89% represents an increase of 231.20%. This represents by far the largest increase in time loss injury claim trends. As reported in earlier studies [44, 45, 50, 51], our study identifies a notable correlation between age and susceptibility to mental health-related injuries among firefighters. Specifically, firefighters aged 40 and over, reflecting individuals with job seniority, exhibit heightened vulnerability to such mental disorders. Alarming, our findings indicate a progressive escalation in the burden of mental health-related injuries over time, signifying a pressing need for comprehensive strategies to address the mental well-being of firefighters [50-52].

While cardiovascular disease (CVD) burden has been extensively documented in the literature [25, 53-57], our study reveals a comparatively lower mortality rate attributed to CVD among firefighters, accounting for only 4.2% of fatality claims. In contrast, traumatic injuries emerged as a significant cause of fatalities in our study, surpassing the mortality rates associated with CVD. This finding diverges from previous research [6, 7, 9, 11, 15], which predominantly emphasized the non-fatal injury burdens among firefighters.

Despite the limitations inherent in analyzing claims data to assess the morbidity and mortality burden among firefighters, this study presents alarmingly high rates of cancer and mental health disorder associated with the occupation of firefighting. Awareness and regulations that emphasize healthy working environment for firefighters should be dedicated to promoting health and enhancing firefighters' lifestyle include dealing with stressful situations and traumatic events that significantly impact their mental health and wellbeing [31, 50]. As not all fatality and injury claims were submitted and incorporated in this study's analyses, the outcome of this finding may not accurately reflect the burden for the entire firefighters' population. There is a need for a surveillance model to capture all fatality and injuries sustained by firefighters.

Findings from this study warrant further examination of the types of occupational fatalities or injuries experienced by firefighters and the association with firefighters' demographics, characteristics of work, and type of disease developed. This investigation will provide a deeper understanding of firefighters' increased risks, to predict the prevalence of particular injuries or diseases, with the ultimate aim to develop improved prediction and prevention programs and practices.

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Appendix A – Data Analysis Code Grouping based on WorkSafeBC for Nature of Injury

Analysis Grouping	WorkSafeBC Coding
Traumatic Injuries and Disorders	0000- Traumatic Injuries & Disorders, uns. 0100- Traumatic Injury-Bones, Nerves, Spinal cord, uns. 01100- Dislocations 01200- Fractures 01300- Traumatic Injury to Spinal cord 01400- Traumatic Injury-Nerves, except Spinal cord 01800- Multiple Traumatic Injury-Bones, Nerves, Spinal cord 01900- Traumatic Injury-Bones, Nerves, Spinal cord, n.e.c. 02000- Traumatic Injury to Muscles, Joints, etc. uns. 02100- Sprains, Strains, Tears 02101- Rotatorcuff Tear, Traumatic 02190- Sprains, Strains, Tears, n.e.c. 02190- Injury to Muscles, Tendons, Joints, etc, n.e.c. 02901- Traumatic Bursitis 02902- Traumatic Tendonitis 02903- Traumatic Epidondylitis 02904- Traumatic Capsulitis 02905- Traumatic Ganglion 02906- Traumatic Synovitis 02907- Traumatic Tenosynovitis 02908- Traumatic Myositis 02909- Traumatic Injury to Muscles, Joints, n.e.c. 03000- Open Wounds 03100- Amputation, uns. 03110- Amputation, Fingertip 03190- Amputations, n.e.c. 03200- Animal or Insect Bites 03300- Avulsions 03400- Cuts, Lacerations 03500- Enucleations 03600- Gunshot wounds 03700- Punctures, except Bites 03800- Multiple open Wounds 03900- Open Wounds, n.e.c. 04000- Surface Wounds and Bruises, uns. 04100- Abrasions, Scratches 04200- Blisters 04300- Bruises, Contusions 04400- Foreign Bodies-Superficial Splinters, Chips 04500- Friction Burns 04800- Multiple Surface Wounds And Bruises 04900- Surface Wounds And Bruises, n.e.c. 05000- Burns, uns. 05100- Chemical Burns, uns. 05101- First-Degree Chemical Burns 05102- Second-Degree Chemical Burns 05103- Third-Degree Chemical Burns 05190- Chemical Burns, n.e.c. 05200- Electrical Burns, uns. 05201- First-Degree Electrical Burns

Analysis Grouping	WorkSafeBC Coding
	05202- Second-Degree Electrical Burns
	05203- Third-Degree Electrical Burns
	05290- Electrical Burns, n.e.c.
	05300- Heat Burns, Scalds, uns.
	05301- First-Degree Heat Burns, Scalds
	05302- Second-Degree Heat Burns, Scalds
	05303- Third-Degree Heat Burns, Scalds
	05390- Heat Burns, Scalds, n.e.c.
	05800- Multiple Burns
	05900- Burns, n.e.c.
	06000- Intracranial Injuries, uns.
	06100- Cerebral Hemorrhages
	06200- Concussions
	06800- Multiple Intracranial Injuries
	06900- Intracranial Injuries, n.e.c.
	07000- Effects of Environmental Conditions, uns.
	07100- Effects of Reduced Temperature, uns.
	07110- Frostbite
	07120- Hypothermia
	07130- Trench Foot
	07180- Multiple Effects of Reduced Temperature
	07190- Effects of Reduced Temperature, n.e.c.
	07200- Effects of Heat and Light, uns.
	07210- Heat Stroke
	07220- Heat Syncope
	07230- Heat Fatigue
	07240- Heat Edema
	07280- Multiple Effects of Heat and Light
	07290- Effects of Heat and Light, n.e.c.
	07300- Effects of Air Pressure, uns.
	07310- Aero-Otitis Media
	07320- Arosinusitis
	07330- Caisson Disease, Bends, Divers Palsy
	07380- Multiple Effects of Air Pressure
	07390- Effects of Air Pressure, n.e.c.
	07800- Multiple Effects of Environmental Conditions
	07900- Effects of Environmental Conditions, n.e.c.
	08000- Multiple Traumatic Injuries, Disorders, uns.
	08100- Cuts, Abrasions, Bruises
	08200- Sprains and Bruises
	08300- Fractures and Burns
	08400- Fractures and other Injuries
	08500- Burns And other Injuries
	08600- Intracranial and Internal Organ Injury
	08900- Other Combi-Traumatic Injury, Disorder, n.e.c.
	08901- Multiple Traumatic Injury, Disorder with Fracture
	08902- Multiple Traumatic Injury, Disorder no Fracture
	09000- Other Traumatic Injuries, Disorders, uns.
	09100- Asphyxiation, Strangulation, Suffocation
	09200- Drownings
	09300- Electrocutions, Electric Shocks
	09400- Internal Injury to Trunk, Blood Vessels, Organs
	09500- Other Poisonings, Toxic Effects, uns.
	09510- Animal or Insect Bites, Venomous

Analysis Grouping	WorkSafeBC Coding
	09520- Radiation Sickness 09590- Other Poisonings, Toxic Effects, n.e.c. 09600- Traumatic Complications, uns. 09610- Traumatic Shock 09620- Embolism, Air or Fat 09680- Multiple Traumatic Complications 09690- Traumatic Complications, n.e.c. 09700- Nonspecific Injuries & Disorders, uns. 09710- Crushing Injuries 09720- Back Pain, Hurt Back 09730- Soreness, Pain, Hurt, Except the Back 09780- Multiple Nonspecific Injuries & Disorders 09790- Nonspecific Injuries, Disorders, n.e.c. 09900- Other Traumatic Injuries, Disorders, n.e.c.
Other systemic diseases and disorders	10000- Systemic Diseases and Disorders, uns. 11000- Disease Of Blood & Blood-forming Organs, uns. 11100- Hemolytic Anemia--Non-Autoimmune 11200- Aplastic Anemia 11300- Agranulocytosis or Neutropenia 11400- Methemoglobinemia 11500- Purpura, Other Hemorrhagic Conditions 11900- Disease of Blood & Blood-forming Organs, n.e.c. 19000- Other Systemic Diseases & Disorders, uns. 19100- Endocrine, Metabolic, Immunity Disorder, uns. 19110- Diseases and Disorders of Thyroid Gland 19120- Diseases, Disorders-Other Endocrine Glands 19190- Endocrine, Nutritional, Immunity Disorder, n.e.c. 19900- Systemic Diseases & Disorders, n.e.c. 19901- Scleroderma
Nervous system and sense organs diseases	12000- Nervous System, Sense Organs Diseases, uns. 12100- Inflammation Disease, Central Nervous system, uns. 12110- Encephalitis 12120- Meningitis 12190- Inflammation Disease, Central Nervous system, n.e.c. 12200- Degenerative Disease, Central Nervous system, uns. 12210- Cerebellar Ataxia 12220- Reye's Syndrome 12290- Degenerative Disease, Central Nervous system, n.e.c. 12300- Other Disorder, Central Nervous System, uns. 12310- Anoxic Brain Damage 12320- Migraine 12390- Other Disorder, Central Nervous System, n.e.c. 12400- Disorders, Peripheral Nervous System, uns. 12410- Carpal Tunnel Syndrome 12420- Inflammatory & Toxic Neuropathy, Polyneuropathy 12430- Toxic Myoneural Disorders 12490- Other Disorder, Peripheral Nervous System, n.e.c. 12491- Bells Palsy 12500- Disorders Of The Eye, Adnexa, Vision, uns. 12510- Solar Retinopathy 12520- Conjunctivitis--Non-Viral 12521- Eye Ulcer, Corneal Erosion 12530- Inflammation Except Conjunctivitis 12540- Cataract

Analysis Grouping	WorkSafeBC Coding
	12550- Blindness, Low Vision 12560- Welder's Flash 12570- Glaucoma 12580- Visual Disturbances 12590- Disorders Of The Eye, Adnexa, Vision, n.e.c. 12600- Disorders: Ear, Mastoid Process, Hearing, uns. 12610- Deafness, Hearing Loss Or Impairment 12620- Tinnitus 12630- Otagia 12640- Mastoiditis 12650- Otitis Media (Except Aero-) 12690- Disorder: Ear, Mastoid Process, Hearing, n.e.c. 12900- Nervous System, Sense Organs Disease, n.e.c.
Circulatory system diseases	13000- Circulatory System Diseases, uns. 13100- Rheumatic Fever with Heart Involvement 13200- Hypertensive Disease 13300- Ischemic Heart Disease, uns. 13310- Myocardial Infarction (Heart Attack) 13320- Angina 13390- Ischemic Heart Disease, n.e.c. 13400- Diseases of Pulmonary Circulation, uns. 13410- Pulmonary Heart Disease 13490- Diseases of Pulmonary Circulation, n.e.c 13500- Other Forms of Heart Disease, uns. 13510- Toxic Myocarditis 13520- Heart Failure 13530- Ill-Defined & Complication of Heart Disease 13590- Other Forms of Heart Disease, n.e.c. 13600- Cerebrovascular Disease, uns. 13610- Stroke 13620- Transient Ischemic Attacks 13690- Cerebrovascular Disease, n.e.c. 13700- Disease-Artery, Arteriole, Capillary, uns. 13710- Raynauds Syndrome, Phenomenon: White Finger 13720- Aneurysm--Nontraumatic 13790- Disease- Artery, Arteriole, Capillary, n.e.c 13800- Diseases Of The Veins, Lymphatics, uns. 13810- Varicose Veins 13820- Hemorrhoids 13830- Phlebitis 13890- Diseases of the Veins, Lymphatics, n.e.c 13900- Circulatory System Diseases, n.e.c. 13901- Telangiectasis (Aluminum Workers)
Respiratory system diseases	14000- Respiratory System Diseases, uns. 14100- Acute Respiratory Infection, Including Common Cold 14200- Other Disease, Upper Respiratory Tract, uns. 14210- Allergic Rhinitis 14220- Chronic Condition, Upper Respiratory Tract 14290- Other Disease, Upper Respiratory Tract, n.e.c. 14300- Pneumonia, Influenza, uns. 14310- Pneumonia 14320- Influenza 14330- Legionnaires Disease 14340- Severe Acute Respiratory Syndrome (SARS)

Analysis Grouping	WorkSafeBC Coding
	14390- Pneumonia, Influenza, n.e.c. 14400- Chronic Obstructive Pulmonary Disease, uns. 14410- Bronchitis 14420- Emphysema 14430- Extrinsic Asthma 14440- Extrinsic Allergic Alveolitis, Pneumonitis 14490- Chronic Obstructive Pulmonary Disease, n.e.c. 14491- Chronic Obstructive Lung Disease(C.O.L.D.) 14500- Pneumoconioses, uns. 14510- Coal Workers' Pneumoconiosis 14520- Asbestosis 14530- Silicosis 14540- Talcosis 14550- Aluminosis 14560- Berylliosis 14570- Siderosis 14580- Pneumoconiosis with Tuberculosis 14590- Pneumoconioses, n.e.c. 14600- Pneumonopathy, uns. 14610- Byssinosis, Mill Fever 14620- Metal Fume Fever 14690- Pneumonopathy, n.e.c. 14900- Other Respiratory Diseases, uns. 14910- Humidifier Fever 14920- Pneumonitis, n.e.c. 14930- Pulmonary Edema 14940- Pulmonary Fibrosis, n.e.c. 14950- Atelectasis, Collapsed Lung 14990- Other Respiratory System Diseases, n.e.c 14991- Reactive Airway Dysfunction Syndrome (R.A.D.S.)
Digestive and Genitourinary system diseases and disorders	15000- Digestive System Diseases, Disorders, uns. 15100- Disease: Oral Cavity, Salivary Glands, Jaws 15200- Diseases of Esophagus, Stomach, Duodenum 15300- Hernia, uns. 15310- Inguinal Hernia 15320- Hiatal Hernia 15330- Ventral Hernia 15390- Hernia, n.e.c. 15400- Noninfectious Enteritis & Colitis 15500- Other Diseases of Intestines, Peritoneum 15600- Toxic Hepatitis--Noninfective 15900- Digestive System Disease, Disorder, n.e.c, 16000- Genitourinary System Disease, Disorder, uns. 16100- Nephritis, Nephrotic Syndrome, Nephrosis, uns. 16110- Nephritis 16120- Nephrotic Syndrome 16130- Nephrosis 16190- Nephritis/Nephrotic Syndrome & Nephrosis, n.e.c. 16200- Other Diseases of Urinary System, uns. 16210- Cystitis 16230- Renal Failure 16290- Other Diseases of Urinary System, n.e.c. 16300- Diseases and Disorders-Genital Tract,uns. 16310- Infertility

Analysis Grouping	WorkSafeBC Coding
	16320- Spontaneous Abortion, Miscarriage 16390- Diseases, Disorders-Genital Tract, n.e.c. 16400- Disorders of Breast 16900- Genitourinary System Disease, Disorder, n.e.c.
Musculoskeletal system and connective tissue disease and disorders	17000- Muskuloskelsys, Connect. Tissue Disease, uns. 17100- Arthropathies, Reltd Disorders(Arthritis) 17200- Dorsopathies, uns. 17201- Dorsalgia 17202- Cervicalgia 17210- Sciatica 17220- Lumbago 17230- Disc Disorders 17231- Disloctd, Herniatd, Slippd, Rupturd Disc 17232- Intervertebral Disc Syndrome 17233- Diskarthrosis 17239- Disc Disorders, n.e.c. 17290- Dorsopathies, n.e.c. 17291- Minor Intervertebral Disorders (Mid) 17292- Facett Syndrome 17293- Radiculitis 17300- Inflam. Irritatn Of Joint/Muscle Etc uns. 17310- Bursitis (For Traumatic Use Code 02901) 17320- Synovitis 17330- Tendinitis (For Traumatic Use 02902) 17340- Tenosynovitis 17350- Ganglion/Cystic Tumor 17360- Myositis 17390- Other Inflam/Irrtn of Joint/Muscle/Tendn 17391- Rotator Cuff Syndrome 17392- Duprytren S Contracture 17393- Epicondylitis 17394- Capsulitis 17395- Trigger Finger(Excludes Traumatic 02909) 17400- Osteopthy, Chondropt, Acquird Deformts, uns. 17410- Curvature of Spine 17490- Osteopthy, Chondropt, Acquird Deform, n.e.c. 17900- Muskuloskelsys, Connect Tissue Dis, n.e.c. 17901- Fibromyalgia, Fibrositis, Myofasciitis
Disorders of the skin and subcutaneous tissue	18000- Disorders: Skin, Subcutaneous Tissue, uns. 18100- Infections: Skin, Subcutaneous Tissue, uns. 18110- Carbuncle and Furuncle 18120- Cellulitis and Abscess 18130- Acute Lymphadenitis 18140- Impetigo 18150- Pilonidal Cyst 18160- Pyoderma 18190- Infection: Skin, Subcutaneous Tissue, n.e.c. 18200- Dermatitis, uns. 18210- Atopic Dermatitis and Related Conditions 18220- Contact Dermatitis and Other Eczema 18230- Allergic Dermatitis 18240- Irritant Dermatitis 18250- Other Contact Dermatitis 18260- Dermat Due to Substance Taken Internally

Analysis Grouping	WorkSafeBC Coding
	18290- Dermatitis, n.e.c. 18300- Other Inflammatory Condition of Skin, uns. 18310- Erythematosquamous Dermatitis 18320- Bullous Dermatoses 18330- Rosacea 18340- Other Erythematous Conditions 18350- Psoriasis and Similar Disorders 18360- Lichen 18370- Pruritus and Related Conditions 18390- Other Inflammatory Conditions, n.e.c. 18400- Diseases of Sebaceous Glands, uns. 18410- Acne 18420- Sebaceous Cyst 18490- Diseases of Sebaceous Glands, n.e.c. 18900- Other Diseases, Disorders-Skin, Subcut. Tissue, uns. 18910- Corns, Callosities (Incl Callus, Clavus) 18920- Other Hypertrophic, Atrophic Conditions 18930- Diseases of Nail (Incl Ingrowing Nail) 18940- Diseases of Hair and Hair Follicles 18950- Disorder: Sweat Glands(Incl Prickly Heat) 18960- Vitiligo 18970- Chronic Skin Ulcers 18980- Urticaria, Hives 18990- Other Diseases, Diso: Skin, Subcut. Tissue, n.e.c.
Infectious and parasitic diseases	20000- Infectious & Parasitic Diseases, uns. 21000- Bacterial Diseases, uns. 21100- Tuberculoses, uns. 21110- Primary Tuberculous Infection 21120- Pulmonary Tuberculosis 21130- Miliary Tuberculosis 21190- Tuberculoses, n.e.c. 21200- Zoonotic Bacterial Diseases, uns. 21210- Plague 21220- Tularemia 21230- Anthrax 21240- Brucellosis 21250- Glanders 21260- Melioidosis 21270- Rat-Bite Fever 21290- Zoonotic Bacterial Diseases, n.e.c.. 21300- Syphilis and Other Venereal Diseases, uns. 21310- Early Syphilis 21320- Cardiovascular Syphilis 21330- Neurosyphilis 21340- Gonorrhoea and Other Gonococcal Infections 21390- Syphilis & Other Venereal Diseases, n.e.c.. 21400- Other Spirochetal Diseases, uns. 21410- Leptospirosis 21420- Vincent's Angina 21430- Yaws 21440- Pinta 21490- Other Spirochetal Diseases, n.e.c.. 21900- Other Bacterial Diseases, uns. 21910- Leprosy

Analysis Grouping	WorkSafeBC Coding
	21920- Diphtheria, Whooping Cough
	21930- Streptococcal Sore Throat And Scarlatina
	21940- Erysipelas
	21950- Meningococcal Infection
	21960- Tetanus
	21970- Septicemia
	21980- Actinomycotic Infections
	21990- Other Bacterial Diseases, n.e.c.
	21991- Necrotizing Fasciitis
	22000- Viral Diseases, uns.
	22100- Human Immunodeficiency Virus(Hiv) Infection, uns.
	22110- Acquired Immune Deficiency Syndrome(Aids)
	22120- Aids-Like Syndrome, Aids-Related Complex(Arc)
	22190- HIV Infection, n.e.c.
	22191- Contact: Bioliquld(Body Fluid)Contamd(HIV)
	22192- Contact: HIV Caused By Aggression
	22193- Asymptmtc HIV + Not Otherwise Specified, Unconfirmed
	22200- Non-Arthrp-d-Borne Viraldis. Cnervsyst, uns.
	22210- Acute Poliomyelitis
	22220- Slow Virus Infection-Centrl Nerv.System
	22230- Meningitis Due To Enterovirus
	22240- Other Enterovirus Diseases
	22290- Non-Arthrp-d-Borne Viraldis. C Nervsys, n.e.c.
	22300- Viral Diseas Accompanied By Exanthem, uns.
	22310- Smallpox
	22320- Cowpox And Paravaccinia
	22330- Chickenpox
	22340- Herpes Zoster
	22350- Herpes Simplex
	22360- Measles
	22370- Rubella/German Measles
	22390- Viral Disease Accompanied by Exanthem, n.e.c.
	22400- Arthropod-Borne Viral Diseases, uns.
	22410- Yellow Fever
	22420- Dengue
	22430- Viral Encephalitis
	22440- Hemorrhagic Fever
	22450- West Nile Viral Disease
	22490- Arthropod-Borne Viral Diseases, n.e.c.
	22500- Viral Hepatitis, uns.
	22510- Type A Viral Hepatitis(Infectious Hepat)
	22520- Type B Viral Hepatitis (Serum Hepatitis)
	22530- Hepatitis C
	22590- Non Type A or Type B Viral Hepatitis
	22600- Viral Diseases of the Conjunctiva, uns.
	22610- Trachoma
	22620- Viral Conjunctivitis (Ophthalmia)
	22690- Viral Diseases of the Conjunctiva, n.e.c
	22900- Other Disease due to Viruses, Chlamydiae, uns.
	22910- Rabies
	22920- Mumps
	22930- Ornithosis, Including Parrot Fever, Psittacosis
	22940- Specific Diseases due to Coxsackie Virus
	22950- Infectious Mononucleosis

Analysis Grouping	WorkSafeBC Coding
	22960- Cat Scratch Disease
	22970- Foot and Mouth Disease
	22990- Other Disease due to Virus, Chlamydiae, n.e.c
	22991- Wart
	23000- Other Arthropod-Borne Diseases
	23100- Rickettsioses Diseases, uns.
	23110- Spotted Fevers
	23120- Q Fever
	23130- Tick Typhus
	23140- Trench Fever
	23190- Rickettsioses Diseases, n.e.c.
	23200- Typhus
	23300- Malaria
	23400- Leishmaniasis
	23500- Trypanosomiasis (Including Chagas Disease)
	23600- Relapsing Fever
	23700- Lyme Disease
	23900- Other Arthropod-Borne Diseases, n.e.c.
	24000- Mycoses, uns.
	24100- Dermatophytosis (Including Athletes Foot, Tinea)
	24200- Dermatomycosis
	24300- Candidiasis
	24400- Coccidioidomycosis
	24500- Histoplasmosis
	24600- Blastomycotic Infection
	24900- Mycoses, n.e.c.
	25000- Helminthiasis, uns.
	25100- Schistosomiasis (Including Bilharziasis)
	25200- Other Trematode Infection (Including Fluke)
	25300- Echinococcosis
	25400- Other Cestode Infection (Including Tapeworm)
	25500- Trichinosis
	25600- Filarial Infection and Dracontiasis
	25700- Ancylostomiasis and Necatoriasis
	25800- Unspecified Intestinal Parasitism
	25900- Helminthiasis, n.e.c.
	26000- Infects Disease Peculiar to Intestine, uns.
	26100- Cholera
	26200- Typhoid and Paratyphoid Fevers
	26300- Other Salmonella Infections
	26400- Shigellosis
	26500- Other Bacterial Food Poisoning
	26600- Amebiasis
	26700- Colitis
	26800- Dysentery
	26900- Infects Disease Peculiar To Intestine, n.e.c.
	29000- Other Infectious, Parasitic Diseases, uns.
	29100- Toxoplasmosis
	29200- Trichomoniasis
	29300- Pediculosis, Phthirus Infestation (Lice)
	29400- Acariasis (Including Scabies, Chiggers, Mites)
	29500- Other Infestation Including Maggots, Jigger Disease
	29600- Sarcoidosis
	29900- Other Infectious, Parasitic Diseases, n.e.c.

Analysis Grouping	WorkSafeBC Coding
Neoplasms, tumors, and cancer	30000- Neoplasms, Tumors, and Cancer 31000- Malignant Neoplasms, Tumors (Cancers), uns. 31100- Malignant Neoplasms, Tumor-Bone/Connective Tissue, uns. 31110- Bone, Articular Cartilage 31120- Connective and Other Soft Tissue 31180- Multiple Malignant Neoplasms, Tumor-Bone/Connective Tissue 31190- Malignant Neoplasms & Tumors Of Bone, n.e.c. 31200- Malignant Neoplasms, Tumors of Skin, uns. 31210- Melanoma of the Skin (Melanocarcinoma) 31220- Nonmelanoma Skincancer (Squams, Basalcell) 31280- Multiple Malignant Neoplasms, Tumors of Skin 31290- Malignant Neoplasms & Tumors of Skin, n.e.c. 31300- Malignant Neoplasms, Tumor: Lymphatic, Hemato. Tissue, uns. 31310- Lymphosarcoma, Reticulosarcoma (Lymphoma) 31320- Hodgkin's Disease 31330- Multiple Myeloma 31340- Leukemias 31380- Multiple Malignant. Neoplasms, Tumor- Lympt, Hemato. Tissue 31390- Malignant Neoplasms, Tumor: Lymptc, Hemato. Tissue, n.e.c. 31900- Malignant Neoplasms, Tumors of other Sites 31901- Mesothelioma 32000- Benign Neoplasms & Tumors, uns. 32100- Benign Neoplasms- Bone, Connective Tissue, Skin, uns. 32110- Benign Neoplasm-Bone, Articular Cartilage 32120- Lipoma (Fatty Tumor) 32130- Benign Neoplasms of the Skin 32140- Other Benign Neoplasms: Connective, Other Soft Tissue 32180- Multi Benign Neoplasms: Bone, Connective Tissue, Skin 32190- Benign Neoplasms of Bone & Skin, n.e.c. 32900- Benign Neoplasms, Tumor of other Sites, uns. 32910- Hemangioma and Lymphangioma: Any Site 32980- Multiple Benign Neoplasms, Tumors: Other Sites 32990- Benign Neoplasms, Tumor of Other Sites, n.e.c. 33000- Neoplasm, Tumor of Unknown Properties, uns. 33100- Bone, Articulr Cartilage Neoplasms, Tumor-Unknown Pro 33200- Connective Other Soft Tissue Neoplasms, Tumor-Unk.Pro 33300- Skin Neoplasms, Tumors- Unknown Properties 33800- Multiple Neoplasm, Tumor of Unknown Properties 33900- Neoplasm, Tumor: Other Sites, Unknown Pro, n.e.c. 39900- Neoplasms, Tumors & Cancer, n.e.c.
Mental disorders or syndromes	52000- Mental Disorder or Syndrome, uns. 52100- Anxiety, Stress, Neurotic Disorders, uns. 52110- Post-Traumatic Stress 52130- Panic Disorder 52190- Other Anxiety, Stress, Neurotic Disorders 52191- Depressive State 52192- Burn Out 52193- Adjustment Disorders 52194- Psychological Decompensation 52200- Organc Mental Disorder- Neurotc, Psychtc, uns. 52210- Substance-Induced Mental Disorder 52220- Organic Affective Syndrome 52280- Multiple Organic Mental disorder- Neurotic, Psychotic 52290- Organic Mental Disorder- Neurotic, Psychotic, n.e.c.

Analysis Grouping	WorkSafeBC Coding
	52900- Mental Disorders or Syndromes, n.e.c. 70002- Post-Traumatic Stress S5.1 Mental Stress
Symptoms, signs, and ill-defined conditions	40000- Symptoms, Signs, Ill-Def. Conditions, uns. 41000- Symptoms, uns. 41100- General Symptoms, uns. 41110- Loss of Consciousness--Not Heat Related 41120- Convulsions, Seizures 41130- Malaise and Fatigue 41140- Dizziness 41150- Non-Specified Allergic Reaction 41151- Sick Building Syndrome 41180- Multiple General Symptoms 41190- General Symptoms, n.e.c. 41200- Symptom Involving Nerves, Musculoskel System, uns. 41210- Spasms or Tremors, n.e.c. 41220- Earache 41230- Eye Strain 41280- Multiple Symptom Involving Nerves, Musculoskelsys 41290- Symptom Involving Nerves, Musculoskel System, n.e.c. 41300- Symptom Involving Skin, Other Integumntry Tissue, uns. 41310- Edema (Including Dropsy) 41320- Cyanosis 41330- Pallor and Flushing 41380- Multiple Symptom. Involving Skin, Other Integum. Tissue 41390- Symptom Involving Skin, Other Integum. Tissue., n.e.c 41400- Symptoms Involving Head and Neck, uns. 41410- Headache, Except Migraine 41420- Loss of Voice, Voice Disturbances 41480- Multiple Symptoms Involving Head, Neck 41490- Symptoms Involving Head and Neck, n.e.c. 41500- Symptom Involving Cardiovascular System, uns. 41510- Unspecified Tachycardia (Rapid Heart Beat) 41520- Gangrene 41530- Enlargement of Lymph Nodes 41580- Multiple Symptoms Involving Cardiovascular System 41590- Symptom Involving Cardiovascular System, n.e.c. 41600- Symptom Involving Respiratory System, Chest, uns. 41610- Hyperventilation 41620- Hemoptysis (Cough With Hemorrhage) 41630- Abnormal Sputum 41640- Chest Pain 41680- Multiple Symptom Involving Respiratory System, Chest 41690- Symptom Involving Respiratory System, Chest, n.e.c 41700- Symptom Involving Digestive, Urinary System, uns. 41710- Nausea and Vomiting 41720- Heartburn 41730- Frequency of Urination and Polyuria 41740- Oliguria and Anuria 41750- Abdominal Pain, uns. 41780- Multiple Symptom Involving Digestive, Urinary System 41790- Symptom Involving Digestive, Urinary System, n.e.c. 41800- Multiple Symptoms 41801- Motion Sickness 41900- Other Symptoms, n.e.c.

Analysis Grouping	WorkSafeBC Coding
	42000- Abnormal Findings, uns.
	42100- Abnormal Findings from Exam of Blood, uns.
	42110- Abnormal Blood Level of Lead
	42120- Abnormal Blood Level of Substances, Except Lead
	42190- Abnormal Findings from Blood Exam, n.e.c.
	42200- Abnormal Findings from Exam of Urine
	42300- Abnormal Findings from other Body Substances
	42400- Abnormal Findings Radiolglcl other Exam, Bodystructure
	42500- Abnormal Findings from Function Studies
	42600- Abnormal Findings from Histolglcl, Immunolglcl Stud
	42700- Multiple Abnormal Findings
	42900- Other Abnormal Findings
	48000- Multiple Symptoms, Sign, Ill-Defined Conditions, uns.
	48100- Multiple Chemical Sensitivity
	48900- Multiple Symptoms, Sign, Ill-Defined. Conditions, n.e.c
	49000- Symptom, Sign, Ill-Defined Condition, n.e.c.
	49001- Contact with or Carriers of Tuberculosis
	49002- Contact with or Carriers of Poliomyolits
	49003- Contact with or Carriers of Rabies
	49009- Contact with or Carrier: Infctv Parasitic Disease
	49100- Contacts with or Carriers of Disease, uns.
	49101- Contact with or Carriers of Tuberculosis
	49102- Contacts with Carriers of Poliomyelitis
	49103- Contacts with or Carriers of Rabies
	49104- Contacts with or Carriers of SARS
	49109- Contact/Carriers Of Infectv Parasitc Disease
	49190- Contacts with or Carriers of Disease, n.e.c.
	50000- Other Diseases, Conditions, Disorders
	51000- Damage to or Loss of Prosthetic Devices
	59000- Other Disease, Conditions, Disorders, n.e.c.
	70001- Chronic Pain
	80000- Multiple Diseases, Conditions, Disorders
	99990- Unknown
	2919- <i>unknown</i>
	2102- <i>unknown</i>
	2911- <i>unknown</i>
	17370- <i>unknown</i>
	2914- <i>unknown</i>
	2917- <i>unknown</i>

Appendix B - Data Analysis Data Grouping based on AWCBC for Nature of Injury

Analysis Grouping	AWCBC Coding
Cancer	30- Neoplasms, tumors, and cancer, unspecified 31- Malignant neoplasms and tumors (cancers, carcinomas, sarcomas) 32- Benign neoplasms and tumors 33- Neoplasms and tumors of unknown properties 39- Neoplasms, tumors, and cancer, not elsewhere classified (n.e.c.)
Cardiovascular system diseases	13- Circulatory system diseases
Digestive system diseases	15- Digestive system diseases and disorders
Genitourinary system diseases	16- Genitourinary system diseases and disorders
Infectious, bacterial, viral, parasitic diseases	20- Infectious and parasitic diseases, unspecified 21- Bacterial diseases 22- Viral diseases 23- Other arthropod-borne diseases 26- Infectious diseases peculiar to the intestines 29- Other infectious and parasitic diseases
Mental health	52- Mental disorders or syndromes
Musculoskeletal system and connective tissue disease	17- Musculoskeletal system and connective tissue diseases and disorders
Nervous system diseases	12- Nervous system and sense organs diseases
Other	41- Symptoms 49- Other symptoms, signs and ill-defined conditions, n.e.c. 59- Other diseases, conditions and disorders, n.e.c. 80- Multiple diseases, conditions, and disorders NC- Not coded
Respiratory system diseases	14- Respiratory system diseases
Skin and subcutaneous tissue diseases	18- Disorders of the skin and subcutaneous tissue
Traumatic injuries	00- Traumatic injuries and disorders, unspecified 01- Traumatic injuries to bones, nerves, spinal cord 02- Traumatic injuries to muscles, tendons, ligaments, joints, etc. 03- Open wounds 04- Surface wounds and bruises 05- Burns 06- Intracranial injuries 07- Effects of environmental conditions 08- Multiple traumatic injuries and disorders 09- Other traumatic injuries and disorders
Unknown	99- Unknown

Appendix C – Culture of Safety for Firefighters Resources

The links below provide additional insights to improving the culture of safety for Firefighters:

- <https://blogs.ufv.ca/cpscjr/2020/07/17/canadian-firefighter-fatality-and-injury-trend-analysis-of-association-of-workers-compensation-boards-of-canada-fatality-and-injury-claims-2006-2018/>
- <https://blogs.ufv.ca/cpscjr/2018/10/25/firefighter-illness-injury-death-in-canada-2006-2015/>
- <https://blogs.ufv.ca/cpscjr/2018/05/24/examining-the-relationship-between-firefighter-injuries-and-fatalities-in-the-built-environment-a-case-for-reducing-the-risk-to-firefighters-through-adequate-firefighting-experience-working-smoke-al/>
- <https://blogs.ufv.ca/cpscjr/2018/03/08/determinants-of-injury-and-death-in-canadian-firefighters-a-case-for-a-national-firefighter-wellness-surveillance-system/>
- <https://blogs.ufv.ca/cpscjr/2017/03/22/occupational-exposure-to-asbestos-among-civic-workers-a-risk-assessment-of-low-dose-exposure/>
- <https://blogs.ufv.ca/cpscjr/2016/02/23/firefighters-cancer/>
- <https://blogs.ufv.ca/cpscjr/2015/07/30/firefighters-and-cancer-understanding-risk-factors-within-an-environment-of-change/>

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