
Occupational Heat Illness in Washington State, 2000-2009

Technical Report Number 59-2-2010

April 2010



Washington State Department of
Labor & Industries

Occupational Heat Illness in Washington State, 2000 – 2009

Technical Report Number 59-1-2010

April 2010

**David Bonauto, MD, MPH¹
Edmund Rauser, PE¹
Louis Lim, MD²**

¹Safety and Health Assessment and Research for Prevention (SHARP) Program, Washington State Department of Labor and Industries, P.O. Box 44330, Olympia, Washington, 98504-4330.

²Department of General Internal Medicine, Division of Occupational Medicine, Harborview Medical Center, 325 Ninth Avenue, MS 359739, Seattle, Washington 98104

Table of Contents

EXECUTIVE SUMMARY	1
INTRODUCTION	2
METHODS.....	3
RESULTS	5
DISCUSSION.....	8

Executive Summary:

We performed a descriptive study of the 483 accepted state fund workers' compensation claims for heat-related illness (HRI) over the 10-year time period from 2000 -2009. The average claim incidence rate for accepted state fund HRI claims over the study period was 3.1 per 100,000 Full-time Equivalent employees. Forty-nine claims (10.2%) involved greater than three days of lost work time and 3 fatalities occurred. The average cost of a state fund HRI claim was \$3,682 which was well below the average cost of a state fund claim, \$8,510, for the ten-year period.

Industry sectors accounting for the most number of claims were Construction - 142 claims (29.4%), and Public Administration – 102 claims (21.1%). In all but Manufacturing and Food Accommodation industry sectors, the majority of claims occurred from exposure to heat in an outdoor environment.

Over 97% (n = 383) of the outdoor HRI claims occurred from May to September. During the ten-year period, there were seventy-one days in which multiple outdoor HRI claims occurred. These days accounted for 222 HRI claims or 55% of the total outdoor HRI claims. The largest number of HRI claims filed in a single day was 11. The median maximum temperature for the business location of the employer for all outdoor HRI claims was 89°F.

Review of the medical records in the claim files revealed evidence of the presence of individual risk factors for HRI inclusive of medication use, co-morbid medical conditions and workers poorly acclimatized for the physical demands of work in hot environments.

Introduction:

Illnesses due to excessive environmental heat exposure, heat-related illnesses (HRI), comprise a spectrum of disorders ranging from minimal health effects up to heat stroke and death; types of HRI include: heat edema, heat cramps, heat syncope, heat exhaustion and heat stroke. All types of HRI are related to elevation of core body temperatures and the metabolic and circulatory processes (including changes in fluid and electrolyte balance) that are brought about by heat strain from exercise, environment and the body's thermoregulatory response. External factors such as the ambient temperature, humidity, wind, sun exposure, physical activity level and clothing that allow effective evaporative cooling can modify the risk of HRI. Factors which predispose a worker to HRI include salt and/or water depletion, medication use, obesity, advanced age, infection, fever, lack of acclimatization, and concurrent medical diseases.^{1,2}

According to the US Department of Labor Bureau of Labor Statistics (BLS), from 2003 – 2008, there were 177 deaths³ and 13,580 cases with days away from work⁴ due to 'Exposure to Environmental Heat' in the private sector workforce. During the last 10 years, Washington State has experienced three worker fatalities related to heat stroke. The death of an agricultural worker in the summer of 2005 prompted a review of workers' compensation claims filed for HRI from 1995 – 2005. In July 2008, The Washington State Department of Labor and Industries adopted rules to control heat stress from outdoor exposure.⁵ This report updates the number of heat-related illness cases from 2000-2009 using comparable methods to previous published Washington heat-related illness data descriptive summaries.

¹ Taiwo OA, Cullen MR. Thermal Stressors. In: Rosenstock L, Cullen MR, Brodtkin CA, Redlich CA. *Textbook of Clinical Occupational and Environmental Medicine, 2nd Ed.* Philadelphia: Elsevier Saunders, 2005; 881-892.

² Barrow MW, Clark KA. Heat-related Illness. *Am Fam Physician* 1998; 58(3):749-756,759.

³ Bureau of Labor Statistics. The National Census of Fatal Occupational Injury, 2009. US Department of Labor, Washington, D.C. Available at <http://www.bls.gov/iif/oshwc/foi/cftb0204.pdf>.

⁴ Bureau of Labor Statistics. Survey of Occupational Injury and Illness, 2009. US Department of Labor, Washington, D.C. Available at <http://www.bls.gov/iif/oshwc/osh/case/ostb1574.pdf>.

⁵ WAC 296-62-095 Outdoor heat exposure; available at <http://www.lni.wa.gov/rules/AO06/40/0640Adoption.pdf>.

Methods:

With few exceptions, Washington State is the exclusive provider of workers compensation insurance to all Washington State employers with workers employed for wages. Notable exceptions to this mandatory insurance provision for employers in Washington State are the federal government, employers who satisfy eligibility criteria to self-insure for workers compensation and the self-employed. Due to case identification and verification protocols this study is restricted to use of the Washington State fund data. About 99.8% of all employers have Washington State fund insurance and employ about 70% of the Washington State workforce.

Heat-related Illness Case Identification: We used the Washington State workers' compensation state fund databases to identify HRI claims. On January 28, 2010, we extracted all accepted state fund workers' compensation claims with any one of the following ICD-9 CM codes: 992.0 - Heat stroke and sunstroke, 992.1 - Heat syncope, 992.2 - Heat cramps, 992.3 –Heat exhaustion, anhydrotic, 992.4 Heat exhaustion due to salt depletion, 992.5 – Heat exhaustion, unspecified, 992.6 – Heat fatigue, transient, 992.7 – Heat edema, 992.8 – Other specified heat effects or 992.9 Effects of Heat and Light, Unspecified; **or** a claim coded with American National Standards Institute (ANSI) Z16.2⁶ *Type* code 151 (Contact with General Heat – Atmosphere or Environment) or a BLS Occupational Injury and Illness Classification System (OIICS) *Nature* code 072* of 'Effects of heat and light' or BLS OIICS *Event* code 321 'Exposure to environmental heat.'⁷ The claims identified were restricted to those with dates of injury between January 1, 2005 and December 31, 2009.⁸

Cases identified as HRI from previous analyses, from January 1, 2000 through December 2005,⁹ were included for analyses but all other information for these claims was updated, specifically cost data and time loss days data.

Data obtained for each claim included claim identification number, the claimants' date of birth, the date of injury, the ANSI/OIICS *nature, type, source,* and *body part* codes for injury classification, the assigned North American Industrial Classification System (NAICS)¹⁰ code for the employers'

⁶ American National Standards Institute. Methods for recording basic facts relating to the nature and occurrence of work injuries. New York, New York. 1969.

⁷ Bureau of Labor Statistics. Occupational Injury and Illness Classification System. US Department of Labor. 2007.

⁸ A limitation of this extraction and the inclusion of 2009 claims are the short duration for claims to emerge and develop; the rationale for inclusion is that most claims occur from May through September and are identifiable through reviews of claim narrative text on the ROA. The narrative text is relatively timely and the OIICS coding derived from text usually only lags by 2 weeks. Estimates of the hours of exposure will develop as well and rates determined based on hours reported in April 2010 are likely significant underestimates.

⁹ Bonauto D, Anderson R, Rauser E, Burke B. Occupational heat illness in Washington State, 1995-2005. *AJIM*. 2007 50(12):940-950.

¹⁰ North American Industrial Classification System Manual, Executive Office of the President, Office of Management and Budget, United States, 2002.

account, the cost of the claim,¹¹ and the worker, physician and employee claim text fields from the Report of Industrial Injury and Occupational Disease (RIIOD) form.

Case Review: Two physicians independently reviewed the RIIOD claim text fields to determine whether the claim was consistent with a heat related illness, e.g. the words appeared in the claim text ‘heat exhaustion’ or ‘heat stroke’. All cases in which at least one physician (D.B.) identified the claim as a possible heat related illness claim were further reviewed by at least one researcher. In this study there were no exclusions for injury location outside of the state of Washington if the claim was covered under the Washington State workers compensation state fund.

The information in the claim file was then reviewed to determine if the heat exposure occurred in an indoor work environment. An indoor work environment was considered to be a work area enclosed by a roof, floor and four walls (e.g., a shed with only three walls was considered to be an outdoor work environment). The claim was reviewed by a physician for information regarding the presence of a potential risk factor for HRI related to medication use, or a concurrent medical condition. Data was also retrieved from the L&I databases regarding the claimants’ duration of employment and occupation as recorded on the RIIOD form.

Temperature Assignment: An approximation of the temperature associated with the worksite of the HRI claimant was determined from using available information regarding first the employers’ business location, then accident location, and then the business mailing location. The assigned location was then matched to one of 12 geographic centers.¹² The daytime maximum temperature (Tmax) for the weather station for county group on the date of injury was recorded and used for analysis. If data was absent for the date of injury at the referent weather station the closest nearby weather station was used. All descriptive analyses were performed with Microsoft Office Excel 2007, SPSS 15.0 Version for Windows and SAS Version 9.2.

¹¹ The cost of the claim for a closed claim is the actual workers’ compensation costs paid for the claim. For an open claim, the costs reflect the actual costs paid to date plus the L&I Case Reserve Unit estimate of the future costs of the claim. Claim costs are not adjusted for inflation.

¹² Data for historical weather information was accessed from the National Oceanographic and Atmospheric Administration ([http:// http://www.ncdc.noaa.gov/oa/ncdc.html](http://www.ncdc.noaa.gov/oa/ncdc.html)). Referent weather stations based on counties led to grouping of Washington’s 39 counties. The counties were grouped as follows: a) San Juan, Island, Whatcom, Skagit; b) Snohomish; c) King, Pierce, Kitsap; d) Clallam, Jefferson, Grays Harbor, Pacific; e) Mason, Thurston, Lewis; f) Wahkiakum, Cowlitz, Clark, Skamania, Klickitat; g) Chelan, Kittitas; h) Okanogan, Ferry, Stevens, Pend Oreille; i) Yakima, Benton, Grant, Douglas, Franklin; j) Walla Walla, Columbia, Garfield, Asotin; k) Adams, Lincoln, Spokane, Whitman.

Results:

There were 483 state fund claims accepted for heat related illness from January 1, 2000 to December 31, 2009. A total of 1.21 million accepted state fund (SF) claims occurred during the study period. Of the 483 HRI claims, 431 (89.2%) were classified as ‘non-compensable’ (medical-only), 49 (10.2%) were considered ‘compensable’ (involves > 3 lost workdays either paid by state-fund or were kept-on-salary by the employer) and there were three fatalities (Table 1).¹³ Men accounted for 388/483 (80.3%) of the claims of HRI. For the 479 HRI claims with age data, the average age of the claimant was 35.4 years old and the median age was 34.0. The age range for HRI claims was from age 14 to age 68. The median and mean age of HRI claimants was similar to all accepted state fund claims where the median and mean ages were 36 and 36.6 years old, respectively. The average and median age for compensable HRI claims were 42 and 46 years old, respectively.

Of the 483 claims, 403 (83.4%) occurred as a result of work outdoors. In all industry sectors, except Manufacturing and Accommodation and Food Services, the majority of HRI claims occurred during outdoor work. Manufacturing had 19/31 claims occurring from work indoors.

Industry Distribution: The industry sector (2 digit NAICS code), industry subsector (3 digit NAICS code) and industry (6 digit NAICS code) distribution for HRI claims, average claim rates and rates restricted to the third quarter are presented in Table 2, 3, and 4 respectively. By industry sector (Table 1), Public Administration (NAICS 92) and Construction (NAICS 23) the accepted HRI outdoor claims rate are 13.1 claims per 100,000 FTE and 9.8 claims per 100,000 FTE, respectively. The Fire Protection Services industry (NAICS 922160) had the highest 3rd Quarter HRI claims incidence rates at 286.7 per 100,000 FTE, followed by Administration of Conservation (NAICS 922160) at 105.2 claims per 100,000 FTE and Roofing Contractors (NAICS 238160) at 97.4 claims per 100,000 FTE (Table 4). The average HRI claim incidence rate for all accepted state fund HRI claims over the 10-year study period was 3.1 per 100,000 FTE. In Construction, 18/141 (12.7%) claims were compensable, while in Agriculture, Forestry and Fishing, 6/33 (15.4%) claims were compensable. Three of the 102 claims in the Public Administration Sector were compensable.

Temporal and Geographic Distribution of Claims: The average number of HRI claims per year was 48 with a range of 28 to 73 claims in a year. The percentage of accepted outdoor HRI claims by the

¹³ All data presented in the results is based on extraction date. The number of Accepted SF claims and those that qualify as compensable are likely to increase with additional development of the data. This limitation exists for all workers compensation data which is not adjusted with development factors. However, in the opinion of the authors, for this report, the development of the data will not significantly alter the observations generated from the data.

month of the injury and cumulative percent by month are presented in Figure 1. The three months of June, July and August had 344 (85.4%) outdoor HRI claims over the 10-year time period. For the five months, from May through September, 393 (97.5%) HRI claims occurred.

Seventy-one days during the study period had multiple outdoor HRI claims. A day with more than one outdoor HRI claim defines a ‘cluster’ of HRI claims. Sixty-eight of the 71 days with a cluster of HRI claims were in June through August. The remaining three HRI clusters occurred in May and September. These clusters represent 222 HRI claims or 55% of all HRI claims. The number of HRI claims in a cluster ranged from 2 to 11 claims.

We reviewed the 398 claims that occurred in an outdoor environment where temperature could be linked to a referent weather station. The median Tmax for HRI cases was 89°F. The range of temperatures was from 36°F and 109°F.¹⁴ Firefighters had outdoor HRI claims with a statistically significant lower average temperature, 78.7 °F than all other outdoor HRI claims, 88.6 °F (p <0.001). The median temperature for a firefighter outdoor HRI claim was 80 °F.

Western Washington accounted for 211/398 (53%) outdoor HRI claims with a county business location.^{15,16}

Risk Factors for HRI: Medication Use and Co-morbid Medical Conditions: The medical information from each claim was reviewed to assess whether medication use by the claimant or a concurrent medical condition could have placed the worker at increased risk for the development of HRI. Due to the non-systematic collection of this type of information within our set of claims, the information available represents a minimum estimate of the presence of medication use or the co-morbid medical conditions in HRI claimants.

Medications used by HRI claimants at the time for their initial evaluation commonly included antihypertensive medications (46 claims) – notably diuretics, beta-blockers, ACE inhibitors or combinations of these medicines. Other medications which possibly placed the worker at risk for HRI included antihistamines, psychiatric medications and anti-seizure medications. For HRI cases occurring from 2006-2009, medications for treatment of adult attention deficit hyperactivity disorder were noted in at least two cases.

Co-morbid medical conditions, which may have placed the worker at increased risk of HRI, were identified in the claims cohort. Common conditions identified in a review of the workers’

¹⁴ Of the outdoor HRI claims with Tmax below 70° F, 11/28 were firefighters.

¹⁵ Claims occurred to Washington workers employed by Washington companies at work locations out of state.

¹⁶ Eastern Washington is defined in this report as L&I regions 5, 6 and Klickitat County. This approximates the area east of the Cascade Mountain range.

compensation claims included a history of a previous HRI, cardiovascular conditions, psychiatric and central nervous system disorders, hypertension, concurrent viral illness and possible overuse of alcohol and illicit drugs. Obesity is a risk factor for HRI. Height and weight data¹⁷ are not systematically recorded in the workers' compensation claim file, and therefore, we can not estimate if obesity was present in HRI claims.

'*Acclimatization*':¹⁸ Variation in environmental temperatures on the incidence of HRI is supported by the grouping of HRI claims during the summer months. Another group of workers potentially at risk are those immediately beginning employment in a work environment requiring significant physical exertion. This group of workers may be poorly adjusted to the ambient environmental temperature where they work or the effects of the significant heat generation associated with increased physical exertion in combination with the ambient temperature to which they are exposed. Of the 483 HRI claims, 410 had information on the 'duration of employment' in the workers' compensation database. Of these 410 HRI claimants, 46 (11.2%) had been employed one week or less. For all state fund claims, the proportion of claimants employed one week or less before their day of injury is estimated to be 3.3%.

Claim Costs: The cumulative cost for the 10 year period for all HRI claims was \$1,778,227. The range of claim costs for all accepted SF HRI claims was from \$0 - \$690,882. The range of non-compensable claim costs for HRI claims was \$0 to \$8,888. The range of compensable claim costs for HRI claims was \$39 to \$690,882. Comparisons of HRI SF claims costs to those of all accepted SF cases are presented in Table 1.

Time Loss: Forty-one claims received time loss compensation. Time loss days paid by the state fund workers' compensation system ranged from 1 – 659 days. The median time loss was 5 days and the mean time loss days paid was 53 (Table1).

¹⁷ Height and weight are used to calculate the Body Mass Index (BMI). $BMI = \text{weight (kg)} / \text{height (m)}^2$. A BMI greater than 30 defines obesity.

¹⁸ Acclimatization is a series of physiologic changes or accommodations made by the body in response to repeated heat stress exposures while conducting work. Acclimatized individuals are physiologically better able to distribute heat within their bodies and lose excess heat to the environment improving safety. They are more comfortable working in heat and the onset of heat strain is delayed (ACGIH 2001 Documentation of the TLVs). Workers exposed to significant heat stress for 5 of the past 7 days are presumed to be acclimatized but maximum acclimatization levels are reached after approximately 3 weeks of exposure. Conversely acclimatization effects are lost in the absence of heat exposure with noticeable losses occurring after 4 days (ACGIH TLV booklet 2001).

Discussion:

We performed a descriptive study of workers' compensation claims filed for heat-related illness over a 10-year time period. Most claims for HRI occurred in the summer months and were associated with work in an outdoor environment. There were 71 days during the 10-year time period in which multiple outdoor HRI claims occurred. Industry sectors with a high number and rate of claims were Public Administration and Construction while specific industries within these sectors had high rates, specifically Fire Protection, Administration of Conservation Programs, Roofing Contractors and Site Preparation Contractors. Supportive evidence regarding the presence of individual risk factors for HRI, medication use, co-morbid medical conditions and workers poorly acclimated to the physical demands of work was found. There is little available literature for which to compare this descriptive study of heat related morbidity and this represents a continuation of monitoring efforts in Washington State.

The limitations to this descriptive study include the likely underreporting of HRI to workers' compensation systems and the under recognition of heat-related illness by workers, employers and the medical community. There is a possibility of misclassification of HRI workers' compensation claims to other diagnosis if the injury was poorly described on the RIIOD form. It cannot be determined if the concurrent medical conditions and medication use cited played a role in the workers development of an HRI or are a coincidental finding. Washington workers' compensation data used in this study was restricted to the state fund employers, thus excluding workers employed at companies that self-insure, federal government workers, workers covered by alternative workers' compensation systems, and those workers exempted from mandatory workers' compensation coverage in Washington State e.g. self-employed workers, household workers, and others.

The methods to assign temperatures to claims can be regarded only as a crude approximation; many of the worksites are not located at the employer's business location and the historical temperature data is from the referent city closest to that business location. Temperatures on the days preceding the HRI claim, the duration of work in hot temperatures, the humidity on the day of injury, wind speeds and other factors (e.g. sun exposure, cloud cover) on the day of injury and are not accounted for in this study.

Nevertheless, the most apparent risk factor for HRI resulting in claim filing is ambient temperature. The recognition of HRI is likely dependent on the health care providers knowledge of elevated ambient conditions or exposures to heat on the job (e.g. firefighters), making the HRI more likely correlated with the recognition of these occupational exposures.

Prevention of HRI centers on recognizing when increased risks are present, minimizing fluid and electrolyte depletion, training the worker on the appropriate intake of fluids, use of appropriate

clothing for hot environments and assessing the appropriate level of work activity that can be performed safely in work environments with elevated temperatures.¹⁹ Intervention efforts in the military have demonstrated significant reductions in HRI case with implementation of these prevention measures.^{20,21}

¹⁹ US Army. Heat Stress Control and Heat Casualty Management. Technical Bulletin - Medical 507, Headquarters Department of Army and Air Force; Washington, D.C. March 7, 2003. Available through the US Army Center for Health Promotion and Preventive Medicine website at <http://chppm-www.apgea.army.mil/heat/>

²⁰ Kerstein MD, Wright D, Connelly J, Hubbard R. 1986. Heat illness in hot/humid environment. *Mil Med* 151:308-11.

²¹ Stonehill RB, Keil PG. 1961. Successful preventive medical measures against heat illness at Lackland Air Force Base. *Am J Pub Hlth* 51:586-590.

Table 1. Characteristics of Washington State Accepted State Fund (SF) Claims for Heat-Related Illness (HRI) Compared with All Washington SF Claims, 2000-2009

	HRI SF Claims Only N = 483	All SF Claims N = 1.21 million
% Male	80.3	69.9
% Age Group	n = 479	n = 1.19 million
14 - 17	2.1	0.9
18 - 24	23.4	18.4
25 - 34	24.8	26.6
35 - 44	23.2	24.8
45 - 54	18.0	19.5
55 - 64	7.9	8.5
65 +	0.6	1.3
Accepted Claims:	n = 483	n = 1.21 million
Average Cost per Claim	\$3,682	\$8,510
Median Cost	\$743	\$512
Non-Compensable Claims Only:	n = 431	n = 907 thousand
Average Cost per Non-Compensable Claim	\$924	\$853
Median Cost	\$695	\$367
Compensable Claims* Only:	n = 52	n = 307 thousand
Average Cost per Compensable Claim	\$26,540	\$31,135
Median Cost	\$2,154	\$6,632
Time Loss Claims	n = 41	n = 265,200
Average Time Loss Days per Claim	53	196
Median Time Loss Days	6	39

* Compensable claims include those with greater than 3 days of lost work time, kept on salary by the employer, resulted in temporary permanent disability or were fatal.

Table 2: Heat-related Illness Claim Rates per 100,000 FTE by Industry Sector in Washington State, 2000 - 2009.

NAICS*	NAICS Description	# HRI Cases	# Outdoor HRI Cases	Outdoor HRI in 3rd Q**	Total FTE***	Total 3rd Q FTE	Avg. Annual Outdoor HRI Rate	Avg. 3rd Q Outdoor HRI Rate
23	Construction	142	132	92	1,351,701	363,445	9.8	25.3
92	Public Administration	102	100	68	762,018	196,610	13.1	34.6
11	Agriculture, Forestry, Fishing and Hunting	39	37	29	590,296	194,898	6.3	14.9
56	Admin., Supp., Waste Mgmt., & Remed. Serv.	34	27	21	889,863	233,503	3.0	9.0
31-33	Manufacturing	31	12	10	1,253,223	319,450	1.0	3.1
72	Accommodation and Food Services	23	5	3	1,289,523	343,107	0.4	0.9
42	Wholesale Trade	19	16	15	922,502	233,997	1.7	6.4
48-49	Transportation and Warehousing	16	15	10	354,739	91,831	4.2	10.9
53	Real Estate and Rental and Leasing	15	15	13	528,886	135,957	2.8	9.6
81	Other Services	12	9	8	773,373	195,760	1.2	4.1
44-45	Retail Trade	10	8	5	1,263,973	322,629	0.6	1.5

* The North American Industrial Classification System (NAICS) is a six-digit hierarchical system where 2 digits reflects the industry sector, 3 digits the industry subsector, and 6 digits the industry.

** The 3rd Quarter is July to September.

*** Full-time Equivalent Employees are 2000 hours per year.

Table 3: Heat-related Illness Claim Rates per 100,000 FTE by Industry-subsector in Washington State, 2000 - 2009.

NAICS*	NAICS Description	# HRI Cases	# Outdoor HRI Cases	Outdoor HRI in 3rd Q**	Total FTE***	Total 3rd Q FTE	Avg. Annual Outdoor HRI Rate	Avg. 3rd Q Outdoor HRI Rate
238	Specialty Trade Contractors	92	83	56	881,019	234,901	9.4	23.8
922	Justice, Public Order, and Safety Activities	44	42	27	166,514	41,941	25.2	64.4
237	Heavy and Civil Engineering Construction	30	29	20	173,219	49,873	16.7	40.1
561	Administrative and Support Services	30	24	18	829,805	217,948	2.9	8.3
111	Crop Production	24	23	18	389,242	136,571	5.9	13.2
921	Exec., Leg., and Other Gen'l Gov't Support	24	24	14	244,983	63,629	9.8	22.0
924	Admin. Environmental Quality Programs	24	24	18	68,549	19,747	35.0	91.2
236	Construction of Buildings	20	20	16	297,464	78,671	6.7	20.3
722	Food Services and Drinking Places	20	4	3	1,052,629	276,612	0.4	1.1
423	Merchant Wholesalers, Durable Goods	14	11	11	498,114	124,958	2.2	8.8
531	Real Estate	13	13	12	440,387	112,597	3.0	10.7

* The North American Industrial Classification System (NAICS) is a six-digit hierarchical system where 2 digits reflects the industry sector, 3 digits the industry subsector, and 6 digits the industry.

** The 3rd Quarter is July to September.

*** Full-time Equivalent Employees are 2000 hours per year.

Table 4: Heat-related Illness Claim Rates per 100,000 FTE by Industry in Washington State, 2000 - 2009.

NAICS*	NAICS Description	# HRI Cases	# Outdoor HRI Cases	Outdoor HRI in 3rd Q**	Total FTE***	Total 3rd Q FTE	Avg. Annual Outdoor HRI Rate	Avg. 3rd Q Outdoor HRI Rate
922160	Fire Protection	39	37	25	34,233	8,720	108.1	286.7
924120	Administration of Conservation Programs	21	21	16	50,987	15,210	41.2	105.2
237310	Highway, Street and Bridge Construction	18	18	13	47,167	15,020	38.2	86.6
238110	Concrete Foundation and Structure Contractors	17	16	11	49,134	13,687	32.6	80.4
238160	Roofing Contractors	17	17	12	43,801	12,317	38.8	97.4
238910	Site Preparation Contractors	17	17	15	54,069	15,853	31.4	94.6
921190	Other Gen'l Gov't Support	14	14	6	155,345	40,858	9.0	14.7
531110	Lessors of Residential Buildings and Dwellings	11	11	11	98,746	25,372	11.1	43.4
561320	Temporary Help Services	11	9	8	254,421	66,587	3.5	12.0
236115	New Single Family Housing Construction	10	10	8	156,738	41,274	6.4	19.4

* The North American Industrial Classification System (NAICS) is a six-digit hierarchical system where 2 digits reflects the industry sector, 3 digits the industry subsector, and 6 digits the industry.

** The 3rd Quarter is July to September.

*** Full-time Equivalent Employees are 2000 hours per year.

Figure 1: % Accepted WA State Outdoor HRI Claims by Month, 2000 - 2009

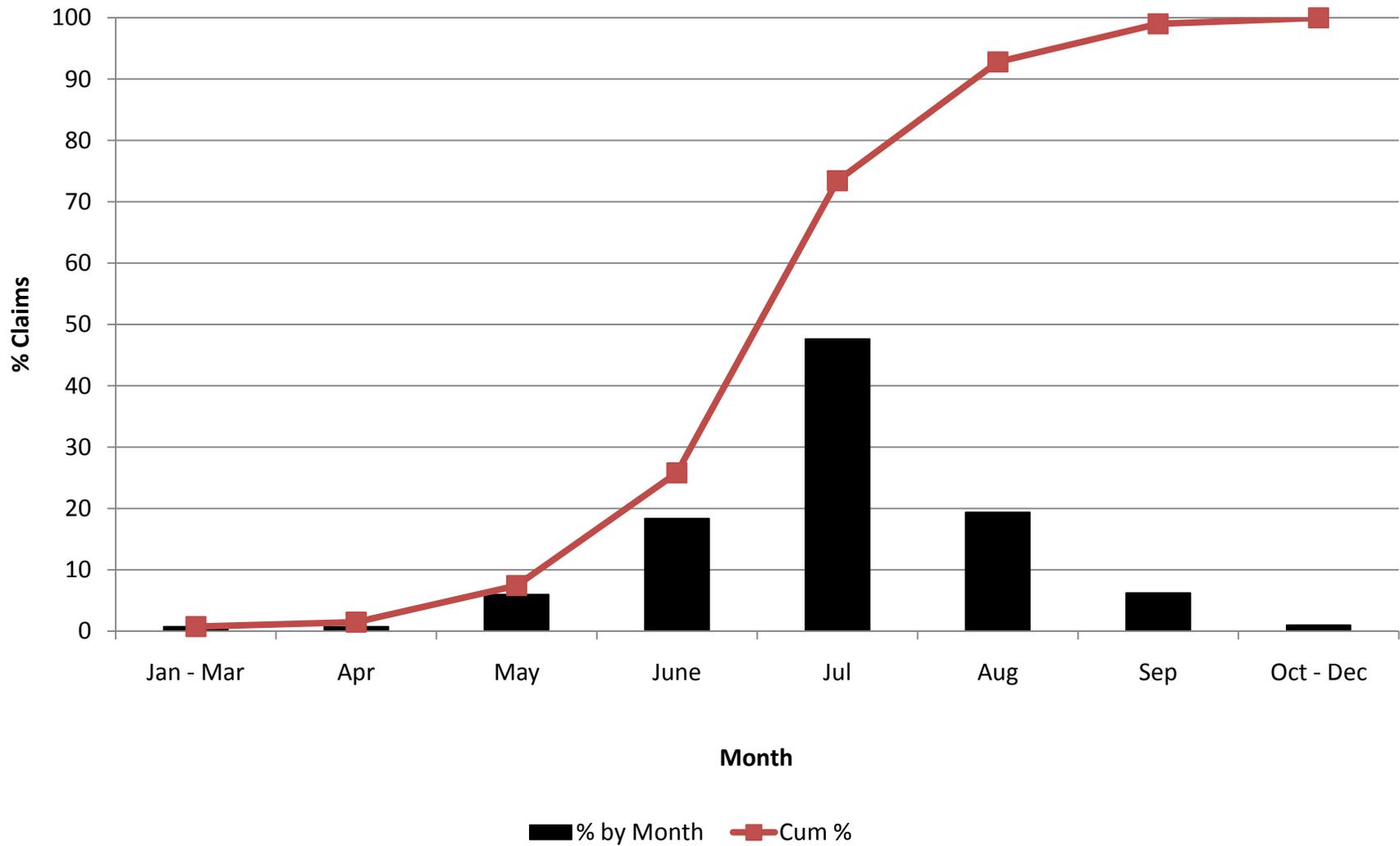


Figure 2: Outdoor Accepted HRI Claims, % by Temperature Category

