Work-Related Burns in Michigan: First Annual Report (January 2009 – December 2009)

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First Annual Report (January 2009 – December 2009)

A Joint Report of

Michigan State University

and

Michigan Department of Licensing and Regulatory Affairs

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Michigan Department of Community Health

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EXECUTIVE SUMMARY

Michigan State University's Occupational and Environmental Medicine Division compiles data on work-related burns in the State of Michigan. This report is the first annual report on occupational burns in Michigan. The key findings are as follows:

- In 2009, the number of work-related burns in Michigan based on the multiple reporting sources was 1,461 which is 3.25 times greater than the official estimate of 450, which is based on reports from employers to the Bureau of Labor Statistics.
- Hospital/emergency department reports identified 1,248 work-related burns, Michigan Workers' Compensation Agency identified 306, Michigan Poison Control Center identified 106, and the Michigan Fatality Assessment and Control Evaluation program identified two deaths from work-related burns. Among the 1,662 reports received from the four reporting sources, 201 were reported by more than one source; thus the total number of work-related burns identified in 2009 was 1,461. Because eight individuals had two separate burn incidents, 1,453 individuals were burned at work in 2009.
- The most common type of medical encounter was an emergency department visit (75.6%).
- Sixty-one percent of all burns were in male workers and 85.3% in Caucasians.
- The most common part of the body burnt were wrists and hands (34.2%) and upper limbs (20.6%).
- Second degree (65.4%) and thermal (65.7%) burns were the most common types of work-related burn.
- Fifty percent of work-related burns occurred to workers in either the Accommodation and Food Services or Healthcare and Social Assistance industries.

BACKGROUND

This is the first annual report on occupational burns in Michigan for the year 2009. Occupational burns are a preventable cause of work-related injury and are among the most traumatic injuries that can occur in a workplace. A traumatic injury is "bodily damage resulting from exposure to physical agents such as mechanical energy, thermal energy, ionizing radiation, or resulting from the deprivation of basic environmental requirements such as oxygen or heat".[1] Health professionals and health facilities are required to report individuals with all injuries, including burns, regardless of cause when requested by the Michigan Department of Community Health (MDCH) or a local health department. This work-related burns surveillance system, based on mandatory reporting, allows the state to identify causes of work-related burns, target interventions to reduce future burns and evaluate the effectiveness of these interventions.

Nationally, the Bureau of Labor Statistics (BLS), the official source of work-related injury statistics reported 24,730 work-related burns in 2009, a rate of 23 workers with burns per 100,000 full-time workers.[2] The BLS estimates are based on employer reporting. The BLS estimate includes private industry and state and local government workers but not the self-employed. BLS reported 450 work-related burns for Michigan in 2009. This corresponds to a rate of 15 per 100,000 full-time workers.

Michigan State University's Occupational and Environmental Medicine Division operates the burn surveillance system as the bona fide agent for the State. Once a work-related diagnosis is confirmed and if a case meets designated criteria, information about the employer where the burn took place is referred to the Michigan Occupational Safety and Health Administration (MIOSHA) so that MIOSHA can conduct a workplace investigation.

DATA SOURCES AND METHODS

There were four reporting sources of work-related burns in 2009:

- Hospitals/Emergency Departments
- Workers' Compensation Agency (WCA)
- Poison Control Center (PCC)
- Michigan Fatality Assessment and Control Evaluation (MIFACE)[3]

All 134 acute care hospitals including Veterans' Administration Hospitals in Michigan were required to report work-related burns. Medical records were used to identify a work-related burn treated at a hospital/emergency department (ED) or as an outpatient visit at a hospital based clinic. A case identified using hospital medical records was defined as an individual aged 16 years or older receiving medical treatment at a Michigan hospital/ED for whom: (a) a burn-related diagnosis code was assigned (International Classification of Diseases, Ninth Revision (ICD-9)[4] codes for burns: 940.0-.9, 941.0-.5, 942.0-.5, 943.0-.5, 944.0-.5, 945.0-.5, 946.0-.5, 947.0-.9, 948.0-.9, 949.0-.5; ICD-9 codes for accidents caused by fire: E890.0-.9, E891.0-.9, E892, E893.0-.9, E894, E895, E896, E897, E898.0-.1, E899), and (b) the incident was documented as having occurred at work in 2009.

The Michigan Department of Licensing and Regulatory Affairs Workers' Compensation Agency provided access to a database of claims for wage replacement due to lost work time. Individuals are eligible for wage replacement when they have had at least seven consecutive days away from work. A case identified using Michigan's workers' compensation system was defined as an individual who was in the lost work time wage replacement database with an accepted claim for work-related burn that occurred in 2009.

A case identified through Michigan's Poison Control Center was defined as an individual for whom a call was made by a burned employee, family member, coworker, or healthcare provider, regarding a consultation of a work-related burn injury in 2009.

A case identified through the Michigan Fatality Assessment and Control Evaluation program was identified as an individual who died from a work-related burn in 2009.

Information from the hospital/ED medical reports, PCC reports and MIFACE reports on each case was abstracted onto a form, including: reporting source(s), type of medical care (hospital, ED, outpatient), hospital name, type of visit, date of admission and discharge, patient demographics, city and county of residence, employer information (name, address, NAICS code), injury date, mechanism of the injury (type of burn), part(s) of body burned, severity of burn, and percentage of burn (%Total Body Surface Area, TBSA). Once these burn data were entered into a Microsoft Access database, records were manually linked to records in the workers' compensation database. Matches were identified using individual's first and last name, date of birth and date of injury. Finally, WCA cases meeting the work-related burn case definition that did not match with the any of the other of the data sources (i.e. where WCA was the sole source of the case report) were identified. Information from workers' compensation on matched cases and new cases was added to the database. Duplicates identified by more than one reporting source were eliminated, after abstracting all information from every data source.

Individuals whose workplaces could not be identified in the records and whose case met the criteria for MIOSHA referral (see p.16) were contacted by telephone to obtain employer information.

For cases whose employers were referred to MIOSHA, additional information was obtained about the results of the referral, including: date of referral, whether an inspection was performed, inspection date, number of violations, and total fines assessed.

Data analysis was performed using queries conducted in Microsoft Access. Burn rates by age, gender, industry were calculated using the U.S. Census/Department of Labor's Current Population Survey for denominators.[5]

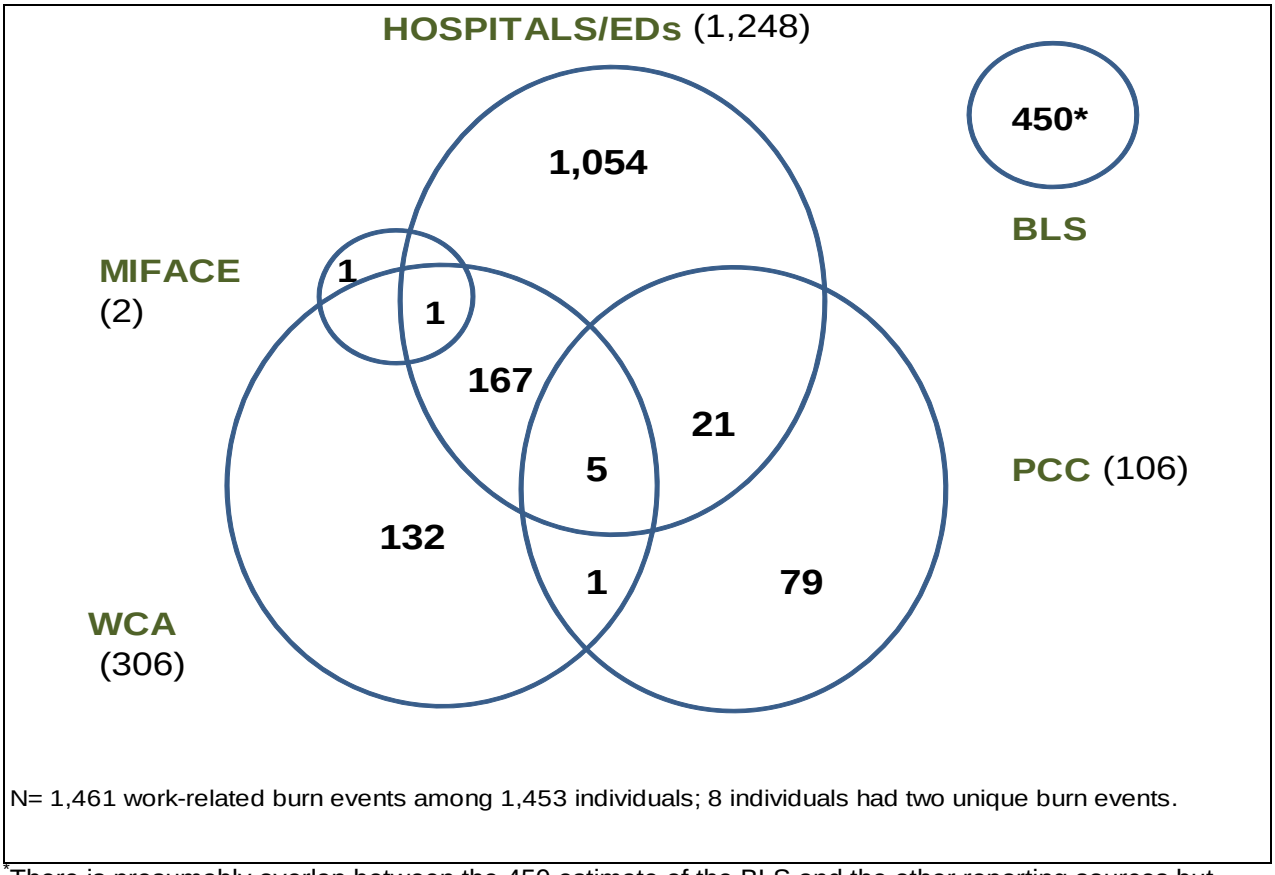
RESULTS

There were 1,461 work-related burn incidents reported from hospital/ED, PCC, WCA, and the MIFACE surveillance program. The 1,461 events represent 1,453 people because 8 individuals each had two unique burn injuries in 2009.

Reporting Sources

The number of work-related burns in Michigan by the reporting source and a comparison with the number estimated by the Bureau of Labor Statistics is shown in Figure1.

Figure 1. Reporting Sources of 1,461 Work-Related Burn Incidents, Michigan 2009



*There is presumably overlap between the 450 estimate of the BLS and the other reporting sources but BLS does not allow access to their data to assess the degree of overlap.

Hospital/ED reports identified 1,248 cases, WCA 306 cases, PCC 106 cases, and MIFACE 2 fatalities. Hospital/ED reports matched 167 WCA reports and 21 PCC reports, 5 both for WCA and PCC reports, and 1 fatality. The other fatality was identified through the MIFACE program only. One burn case was identified by WCA data source and PCC data source but not by the hospital/ED data source. Because of confidentiality restrictions no attempt was made to match our data set with the BLS data set.

Of the 306 WCA cases, 280 were identified because they had been classified as a burn (a thermal burn (262) or a chemical burn (18)). The other 26 were included because they matched with names from one or more of the other data sources, although they had had an injury description in the WCA data base as something other than "burn". Twenty-five were identified after matching with a burn report from a hospital/ED record The descriptions in WCA for these 25 were: 6 "unclassified", 5 "electric shock", 5 "multiple injuries", 2 "fracture", 2 "inflame-joints", 1 "crush/contusion", 1 "cut/laceration", 1 "strain/sprain", 1 "abrasion/scratch", and 1 "toxic material". One WCA case matched a PCC record of a burn. The description of the injury in the WCA data base was "skin infection".

The most common type of medical encounter was an ED visit, 1,104 workers (75.6%), followed by 80 outpatient visits (5.5%), and 64 hospitalizations (4.4%). For 213 (14.5%) cases, which include WCA and PCC records, and one fatality, the type of medical care that workers received was not available.

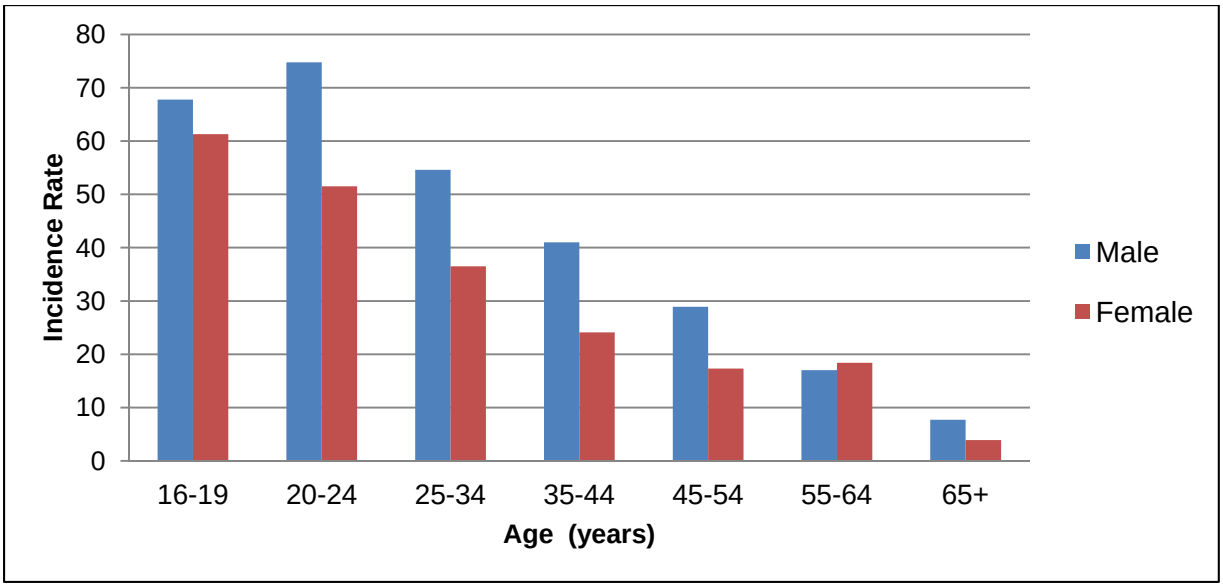
A 60-ton chambered die cast machine was the cause of one of the 64 hospitalizations for a work-related burn.

Characteristics of Injured Workers

Age and Gender

Age was available for 1,451 workers (99.3%); age was unknown for 5 males and 5 females. The age of injured workers ranged from 16 to 72 years. The average age was 35. Eight hundred and eighty-six (60.6%) of all work-related burns were among men. Figure 2 displays burn rates by age group and gender. Among males, rates were highest for workers aged 20-24, while for females the age group with the highest burn rate was 16-19.

Figure 2. Work-Related Burn Rates by Age Group and Gender, Michigan 2009*

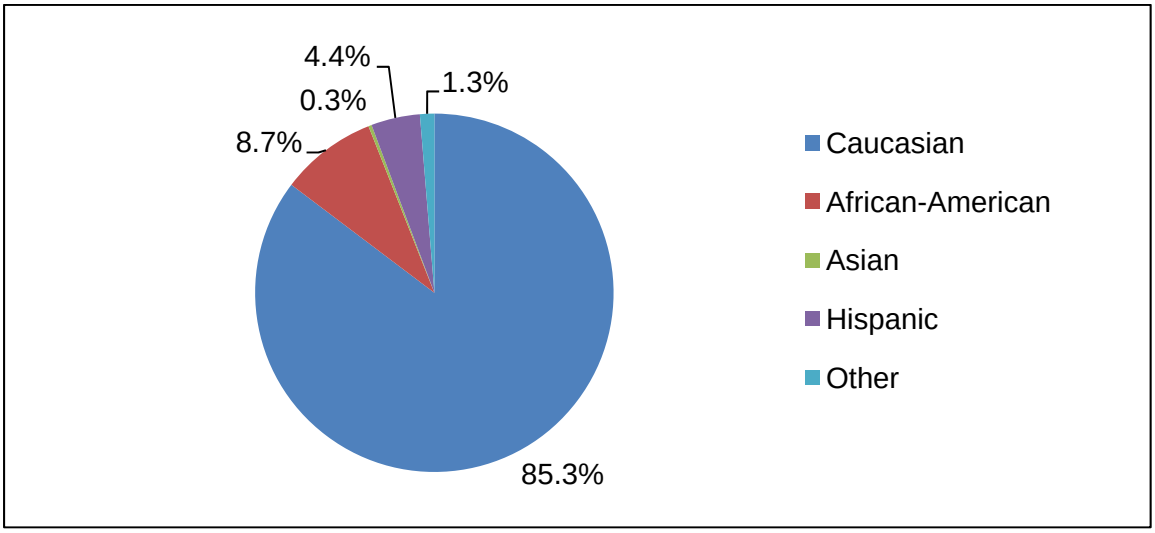


*Rates are the number of workers sustaining a burn per 100,000 workers (number of workers employed by age group used to calculate rates: Bureau of Labor Statistics' Current Population Survey).[5]

Race and Ethnicity

Race and ethnicity of injured workers is shown in Figure 3. Of the workers for whom race was available (744), Caucasians comprised 85.3%, African-Americans 8.7%, and Hispanics 4.4%. Race and ethnicity information was unavailable for 717 workers (49.1%).

Figure 3. Race/Ethnicity Distribution of Work-Related Burns, Michigan 2009*



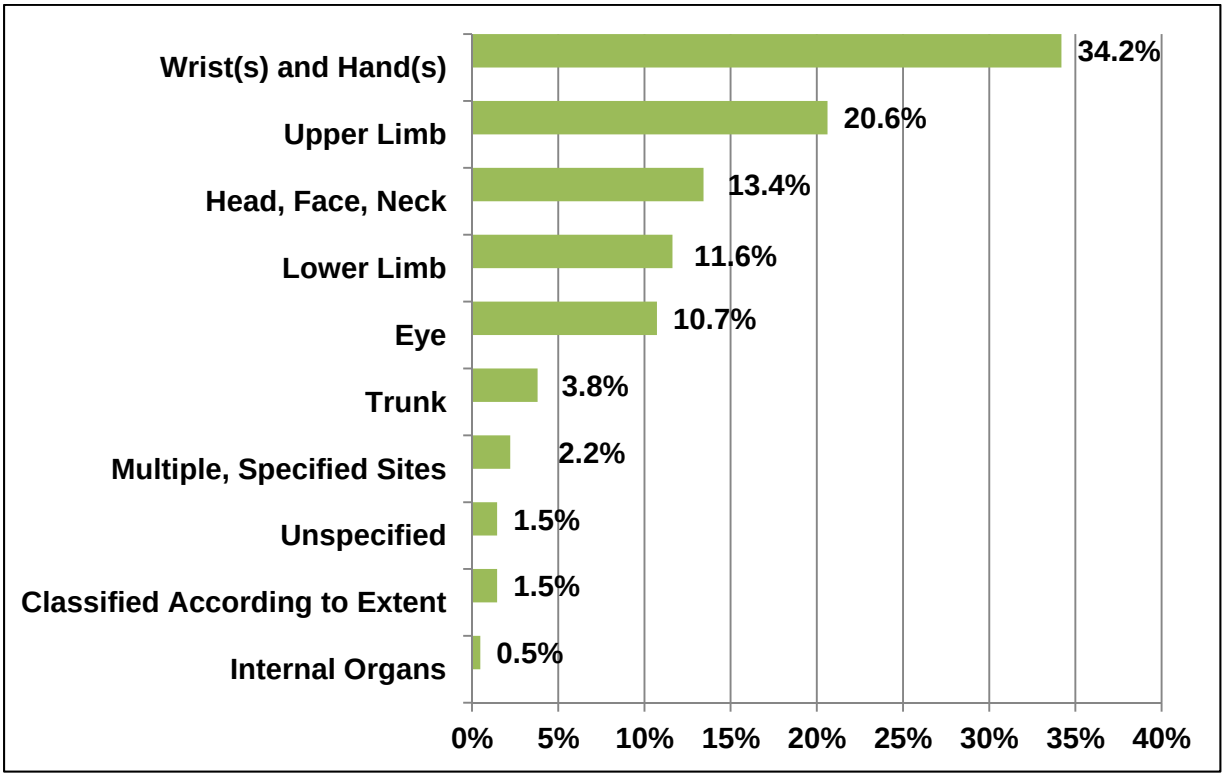
*Race/ethnicity information available for 744 individuals.

Part of Body Injured

Medical records specified the part of body burned and were classified by burns ICD-9 codes (940.0-.9 – 949.0-.5). For 16 medical records which included 11 ICD-9 codes regarding Accidents Caused by Fire and 5 other ICD-9 codes, it was impossible to determine the part of the body injured. The Workers' Compensation database did not list injuries by the ICD-9 codes but specified the part of the body burnt, which was then recoded into the ICD-9 codes. In the Poison Control Center reports the part of the body injured was specified by the caller.

Figure 4 illustrates part of burned body. Part of body injured was specified for 1,445 individuals (98.9%). Burns of wrists and hands occurred most often (34.2%), followed by upper limb burns (20.6%), and then head, face and neck burns (13.4%).

Figure 4. Work-Related Burns by Part of Body Injured, Michigan 2009*



*Percentages based on a burn-related primary diagnosis of 1,445 individuals.

Severity

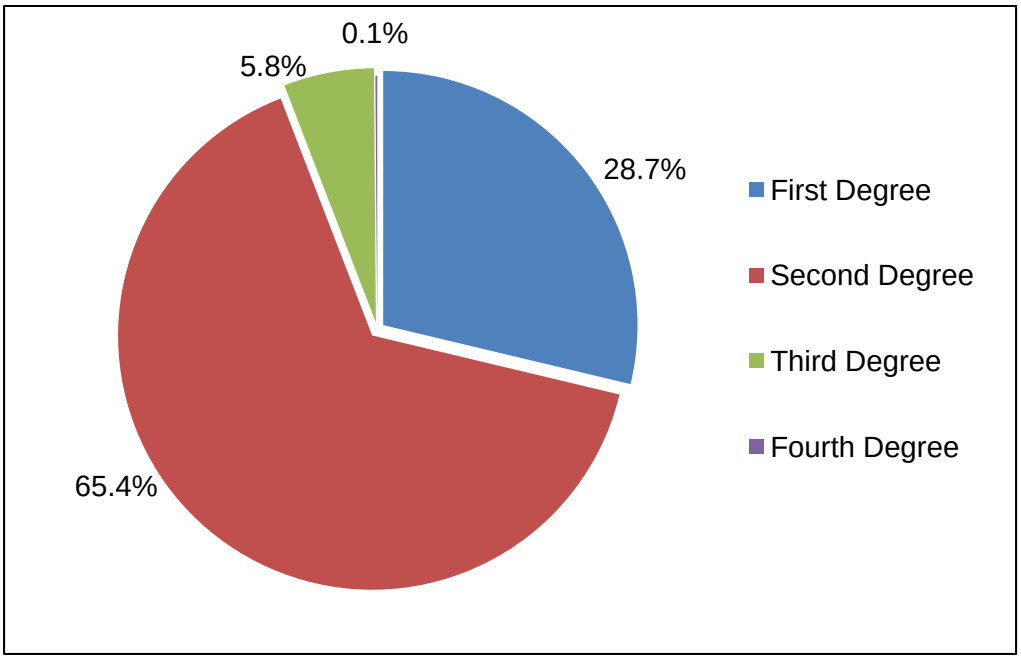
Burns can be described as first, second, third or fourth degree, or as to their thickness, e.g. superficial, partial and full.

A first-degree (superficial) burn is the least serious as it involves only the outermost layer of the skin called the epidermis. A second degree (partial thickness) burn is more serious. The burn involves epidermis and some portion of dermis (the second layer of the skin). A third degree (full thickness) burn involves the first two layers of the skin, the epidermis and dermis. It permanently destroys tissue. A fourth degree burn is the most severe burn as it extends through the epidermis, dermis, subcutaneous tissue and into muscle and bone. The skin is not able to heal by itself in a fourth degree burn.

Degree of burn was specified for 818 individuals (56.0%) and its distribution is illustrated in Figure 5. Five hundred and thirty-five individuals had a second degree burn which was the most common type of burn, followed by a first degree burn in 235 workers, a

third degree burn in 47 workers, and a fourth degree burn in one worker. Percentage of body injured was largely unreported. It was specified for only 145 workers (10.0%), and thus no analysis was performed.

Figure 5. Work-Related Burns by Severity, Michigan 2009*



*Degree of burn was specified for 818 individuals.

County of Residence

Table 1 illustrates the number of workers sustaining a burn and the corresponding percentage by a worker's county of residence. There were 1,206 Michigan residents for whom the county of residence was known (82.6%). There were 13 out-of-state workers and 1 out-of-country worker. County of residence was unknown for 241 Michigan residents (16.5%). Wayne county had the highest number of residents who sustained a work-related burn (151), followed by Oakland (80), and then Macomb (71).

Table 1. Work-Related Burns by County of Residence, Michigan 2009

County	Number	Percent	County	Number	Percent
Alcona	0	0	Leelanau	1	0.1
Alger	1	0.1	Lenawee	24	1.6
Allegan	31	2.1	Livingston	15	1.0
Alpena	9	0.6	Luce	0	0
Antrim	6	0.4	Mackinac	7	0.5
Arenac	4	0.3	Macomb	71	4.9
Baraga	1	0.1	Manistee	9	0.6
Barry	10	0.7	Marquette	16	1.1
Bay	20	1.4	Mason	7	0.5
Benzie	1	0.1	Mecosta	8	1.2
Berrien	23	1.6	Menominee	1	0.1
Branch	7	0.5	Midland	12	0.8
Calhoun	19	1.3	Missaukee	0	0
Cass	7	0.5	Monroe	13	0.9
Charlevoix	1	0.1	Montcalm	12	0.8
Cheboygan	4	0.3	Montmorency	0	0
Chippewa	3	0.2	Muskegon	34	2.3
Clare	4	0.3	Newaygo	16	1.1
Clinton	9	0.6	Oakland	80	5.5
Crawford	0	0	Oceana	8	0.5
Delta	10	0.7	Ogemaw	3	0.2
Dickinson	12	0.8	Ontonagon	0	0
Eaton	18	1.2	Osceola	3	0.2
Emmet	3	0.2	Oscoda	1	0.1
Genesee	55	3.8	Otsego	0	0
Gladwin	6	0.4	Ottawa	24	1.6
Gogebic	3	0.2	Presque Isle	2	0.1
Grand Traverse	13	0.9	Roscommon	3	0.2
Gratiot	13	0.9	Saginaw	8	0.5
Hillsdale	10	0.7	Saint Clair	25	1.7
Houghton	2	0.1	Saint Joseph	13	0.9
Huron	21	1.4	Sanilac	5	0.3
Ingham	30	2.1	Schoolcraft	2	0.1
Ionia	8	0.5	Shiawassee	10	0.7
Iosco	5	0.3	Tuscola	7	0.5
Iron	1	0.1	Van Buren	14	1.0
Isabella	17	1.2	Washtenaw	34	2.3
Jackson	33	2.3	Wayne	151	10.3
Kalamazoo	61	4.2	Wexford	7	0.5
Kalkaska	7	0.5	Out of State	13	0.9
Kent	46	3.1	Out of Country	1	0.1
Keweenaw	0	0	Unknown	241	16.5
Lake	4	0.3			
Lapeer	12	0.8	**Total**	1461	

Industry

Table 2 illustrates the number, percent and rate of work-related burns by industry. For 1,016 individuals (69.5%) there was sufficient information for industry classification. Eleven workers were self-employed. Among Northern American Industry Classification System (NAICS) industry codes, Accommodation and Food Services (two-digit NAICS industry sector: 72) had the highest number of work-related burns (345). The industry with the second highest number of work-related burns was the Health Care and Social Assistance sector (62), which had 168 burns. The two industries combined accounted for 50% of all work-related burns. Most of the burns identified in the Health Care and Social Assistance sector occurred while dealing with food. Firefighters accounted for the majority of burns occurring in the Public Administration industry. Accommodation and Food Services industry had the highest rate (115.8 per 100,000 workers) of burns, followed by Food, Beverage and Textile Manufacturing (79.8 per 100,000 workers).

Table 2. Work-Related Burns by Industry, Michigan 2009*

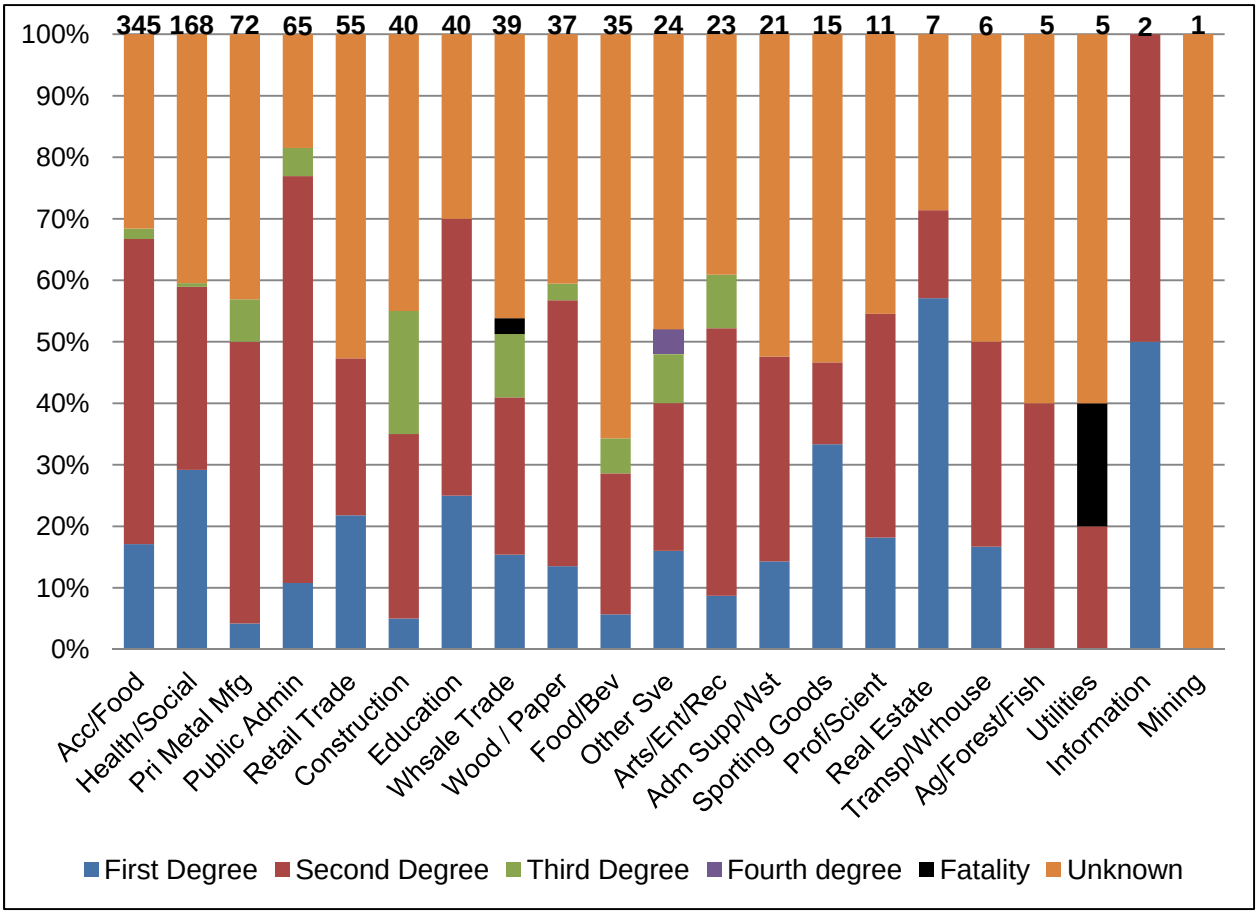
Industry Classification (NAICS)	Number	Percent	Rate*
Accommodation and Food Services (72)	345	34	115.8
Health Care and Social Assistance (62)	168	16.5	25.5
Primary Metal Manufacturing (33)	72	7.1	15.5[1]
Public Administration (92)	65	6.4	42.8
Retail Trade (44)	55	5.4	17.7[2]
Construction (23)	40	3.9	17.4
Educational Services (61)	40	3.9	9.6
Wholesale Trade (42)	39	3.8	38.1
Wood Products/ Paper/ Petroleum and Coal Products Manufacturing (32)	37	3.6	35.2[1]
Food, Beverage, Textile Manufacturing (31)	35	3.4	79.8[1]
Other Services (except Public Administration) (81)	24	2.4	9.3
Arts, Entertainment, and Recreation (71)	23	2.3	30.5
Administrative and Support and Waste Management and Remediation Services (56)	21	2.1	13.0
Sporting Goods, Hobby, Book, and Music Stores (45)	15	1.5	9.7[2]
Professional, Scientific, and Technical Services (54)	11	1.1	4.5
Real Estate and Rental and Leasing (53)	7	0.7	10.4
Transportation and Warehousing (48)	6	0.6	5.9
Agriculture, Forestry, Fishing and Hunting (11)	5	0.5	9.1
Utilities (22)	5	0.5	11.2
Information (51)	2	0.2	2.8
Mining, Quarrying, and Oil and Gas Extraction (21)	1	0.1	10.8
Total of All Burns	1,461**	100.0	34.3

*Rates are the number of workers sustaining a burn per 100,000 workers (number of workers by industry used to calculate rates: Bureau of Labor Statistics' Current Population Survey).
[1] Rates do not include 1,660 individuals from "Not specified manufacturing industries (Part of 31, 32, and 33)". This is 0.3% of workforce with NAICS 31, 32 and 33.
[2] Rates do not include 6,298 individuals from "Not specified retail trade (Part of 44, 45)". This is 1.3% of workforce with NAICS 44 and 45.
**Sufficient information for industry classification was only available for 1,016 individuals.

Severity of Burns within Specific Industries

Figure 6 illustrates severity of burns within specific industries (1,016 individuals). The severity of burns was specified for 624 individuals (61.4%). The predominant degree of burn across all industries was second degree in 411 individuals.

Figure 6. Severity of Burns within Specific Industries, Michigan 2009*



*Numbers above the bars are the total number of fatal and nonfatal burns by industry.

Causes of Burns

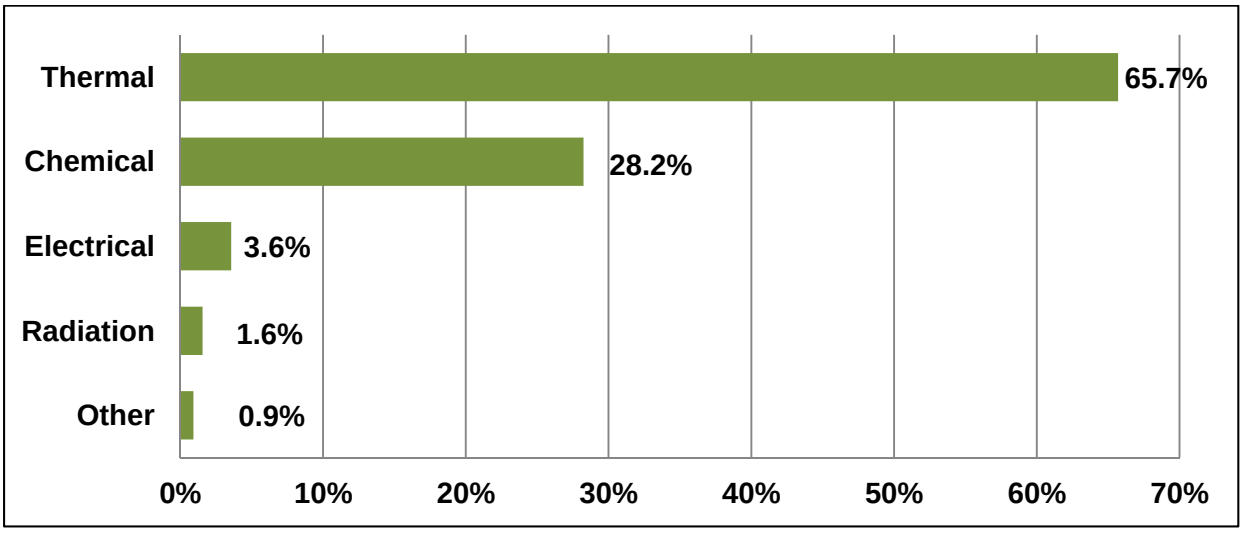
Burns can be caused by a variety of substances and external sources, e.g. heat, chemicals, electricity and radiation. There are 4 major types of burns.

- Thermal – caused by contact with hot surfaces, flames, hot liquids.
- Chemical – caused by acids and other skin damaging chemicals, molten metal compounds, hydrocarbons such as gasoline or hot tar.
- Electrical – caused by contact with electric current.
- Radiation – caused by ultraviolet radiation generated by the electric arch in the welding process.

Side of a truck which served as an energized conductor that resulted in electrical burns to a tree trimming worker.

Burn type was specified for 1,402 workers (96%). The predominant burn type was thermal in 921 workers, followed by chemical in 396 workers, and then electrical in 50 workers. When the industry was specified, Accommodation and Food Services industry had the highest percentage of thermal burns (87.5%). Thirteen percent of chemical burns occurred in the Health Care and Social Assistance industry, followed by 11.2% burns in both Accommodation and Food Services and Primary Metal Manufacturing industries. Some of the kinds of chemicals involved in chemical burns included nitric acid, sulfuric acid, sodium hydroxide, hydrofluoric acid and potassium hydroxide. Among individuals (64) who were hospitalized, thermal exposure was the cause for 43.8%, electrical for 26.6% and chemical for 21.9% of the burns. An electrical burn was more likely to require hospitalization as compared to a chemical or thermal burn, 34%, 3.5%, and 3.0%, respectively.

Figure 7. Work-Related Burn Type, Michigan 2009*



*Burn type specified for 1,402 individuals.

Referrals to MIOSHA

The MIOSHA referral criteria for a work-related burn that occurred in 2009 were that the individual had to have (1) been hospitalized, treated in an ED or treated as an outpatient, (2) sustained a second or third degree burn, and (3) the burn had to have taken place within six months of the referral. There were 17 individuals whose burns met the criteria for a referral to MIOSHA but whose workplace information was not available. Twelve of the 17 were successfully interviewed to obtain their workplace information.

Including the workplaces of 12 individuals interviewed, there were 36 referrals made to MIOSHA regarding work-related burns that occurred in 2009. MIOSHA inspected 6 of the referred workplaces where non-fatal burns occurred and 1 where a fatality occurred. (The second burn fatality was not in MIOSHA's scope of investigation. The incident involved a male in his sixties who was piloting a Beech A36TC when it was destroyed following impact with the ground and a subsequent fire. The decedent had an 80%-90% TBSA of his body burnt.)

Table 3 illustrates the distribution of violations and penalties assessed by the industry type of the seven inspected workplaces.

Table. 3 Workplaces Inspected by MIOSHA: Violations and Penalties Assessed by Industry, Michigan 2009

Industry Type (NAICS)	Number of Violations	Total Penalties Assessed
Aluminum Die-Casting Foundries (331521)	15	$3,300
All Other Plastics Product Manufacturing (326199)	11	$900
Fossil Fuel Electric Power Generation (221112)*	3	$12,600
All Other Specialty Trade Contractors (238990)	3	$5,450
Dry cleaning and Laundry Services (812320)	2	$550
Landscaping Services (561730)	2	$125
Limited-Service Restaurants (722211)	0	$0

*Fatality.

Narratives: Seven Work-Related Burn MIOSHA Enforcement Inspections

- *Aluminum Die-Casting Foundries:* A male in his thirties was operating a molding die press, whose temperature reached 400^0F and maximum pressure was 2000 pounds. The employee's right hand was trapped in the press and he sustained a severe crush injury and burn. The employee was hospitalized for 4 days. MIOSHA's enforcement inspection found 15 violations, including an inadequate guard for point of operation on a manually tended 60-ton die cast machine, and no guard on an interlocked-sliding door opened and bypassed of the 60-ton chambered die cast machine.

- *All Other Plastics Product Manufacturing*: A female in her thirties sustained 3rd degree burns with hot glue and a crush injury after her right hand was caught by a roller press. The employee was hospitalized for 12 days due to the injury and underwent surgery twice for debridement. MIOSHA found 11 violations, including a lack of guard on the machine.

- *Fossil Fuel Electric Power Generation:* A male in his twenties (maintenance journeyman apprentice) was fatally electrocuted after contacting 40,000-volt energized electrical lines. The decedent was performing substation maintenance

to remove and repair electrical cables. On the day of the incident, neither a job briefing nor a "job protection" walkthrough was conducted by the substitute substation operator. The lines were not de-energized or locked out. The decedent placed a six-foot aluminum ladder on gravel to gain access to the lines, which were approximately 10 to 12 feet above ground. The incident was not witnessed. The employee had 30-50% TBSA of his body burnt. MIOSHA's enforcement inspection found 3 violations, including no job briefings; the employer had power to lines that did not require power for the work being performed; the employee was not briefed on the safety zone around the live parts, power transformer.

- *All Other Specialty Trade Contractors:* A male in his fifties was blowing out a pipeline with a high pressure oxygen system that contained oil substances/mineral spirits and there was an explosion. This was not a part of the employee's regular job. The explosion was a result of over pressurization of the metal coil and concentration of oxygen and mineral spirits, which caused rapid expansion and started the fire. The employee sustained 25% TBSA 2nd and 3rd degree burns and was hospitalized for 30 days. MIOSHA's enforcement inspection found 3 violations, including the employer's failure to train and prohibit an employee from pressurizing a metallic vessel with an unregulated 200 cubic foot compressed gas cylinder. This produced a pressure in excess of 2000 pounds per square inch gauge, when it was not supposed to be operated in excess of the 15 pounds per square inch gauge.

- *Dry cleaning and Laundry Services:* A female's in her twenties upper extremity was caught under an iron press in a dry cleaning establishment. The employee sustained 4% TBSA 2nd and 3rd degree burns to the left hand and upper limb. The employee was hospitalized for 4 days. MIOSHA's enforcement inspection found that the two hand controls of the shirt steam press were not guarded against accidental activation.

- *Landscaping Services:* A male in his twenties suffered electrical burns to his posterior trunk, upper extremities, and lower extremities while cutting trees. He was standing by a boom truck when the boom hit an electrical wire and the

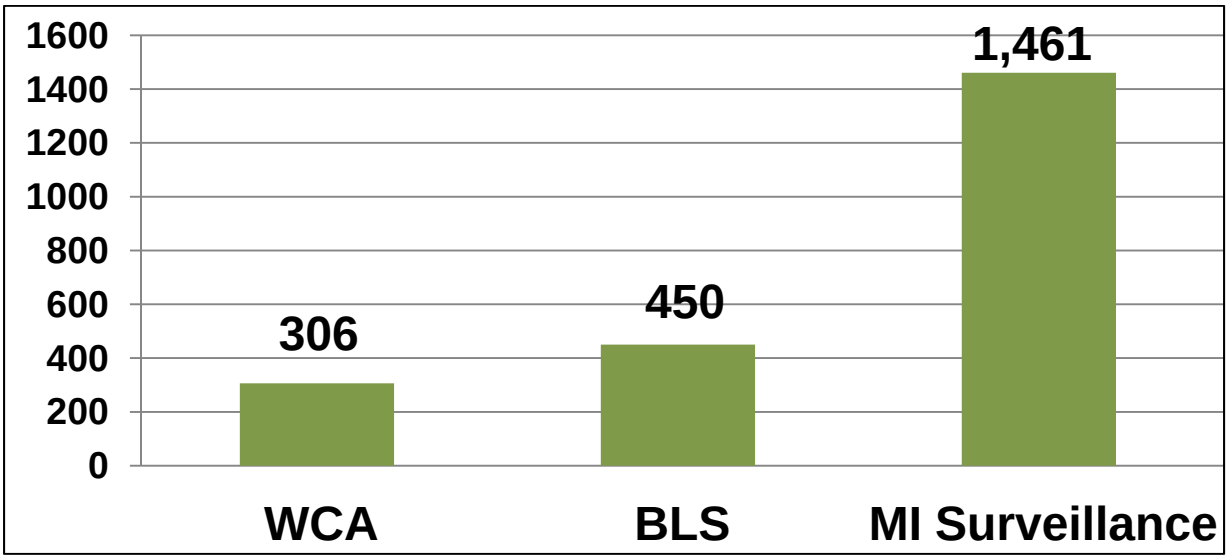
energy from one of the electrical wires was transferred to the truck and the current was conducted through his body to the ground. Employee suffered 12% TBSA 2nd and 3rd degree burns and was hospitalized for 12 days. MIOSHA's enforcement inspection found 2 violations, including that the operator failed to maintain proper safety distance from an energized conductor.

- *Limited-Service Restaurants:* A male in his thirties working in a fast food restaurant slipped and his left hand came down onto the grill surface (350^0F). The employee sustained a 2nd degree burn. MIOSHA's enforcement inspection of the workplace found no slip or trip hazard at the grill area.

DISCUSSION

This is the first annual report on work-related burn data in Michigan. The Michigan comprehensive surveillance system of work-related burns provides a more accurate estimate of the true number of work-related burns than the employer-based reporting system maintained by the Bureau of Labor Statistics, which is the official source of work-related statistics.[6] The Michigan system identified 1,461 work-related burns in comparison to 450 reported by BLS (Figure 8).

Figure 8. Number of work-related burns by three surveillance systems, Michigan 2009



The BLS's undercount of work-related burns may be partially explained by the fact that BLS includes in its statistics only cases with one or more days away from work or with altered work duties, whereas the Michigan multi-source surveillance system counted all work-related burn injuries. Secondly, the BLS excludes self-employed, independent contractors and farm workers who work on farms with less than 11 employees. Michigan's burn surveillance identified only 11 self-employed and 5 farmers with burns so a difference in the type of workers covered in the BLS does not explain the undercount by BLS. Other possible explanations for the BLS undercount may be that employers are not providing complete reporting, or the statistical sampling procedure of BLS or employers are not properly identifying employees' injuries as burns.

Michigan's workers' compensation data also identified many fewer cases than the other data sources combined. Reasons contributing to the workers' compensation undercount include: 1) The WCA data set only included burns that caused 7 consecutive days away from work; 2) WCA excluded self-employed, but again there were only 11 self-employed workers in our more complete reporting system; 3) Coding or miscoding errors in the WCA data. The matching with other data sources showed that 26 work-related burns identified from medical records or the Poison Control Center were not classified as burns in the WCA data. Presumably there were other injuries in the WCA data base that were similarly misclassified. 4) It is possible that some companies are handling burn injuries unofficially and not reporting them to workers' compensation insurance companies or the WCA.

Michigan OSHA Strategic Goal #1.1 for Fiscal Year 2009-2013[7] is to reduce by 20% the rate of worker injuries and illnesses in high-hazard industries, which include: Beverage and Tobacco Product Mfg. (312), Wood Products Mfg. (321), Plastics and Rubber Products Mfg. (326), Nonmetallic Mineral Product Mfg. (327), Primary Metal Mfg. (331), Fabricated Metal Product Mfg. (332), Machinery Mfg. (333), Transportation Equipment Mfg. (336), Recyclable Material Merchant Wholesalers (423930), Merchant Wholesalers, Nondurable Goods (424), Landscaping Services (561730), Hospitals (622), Nursing and Residential Care Facilities (623). Some of the highest rates for work-related burns were not included in these high-hazard industries (i.e. Accommodation and Food Services and Public Administration (Table 2)).

Surveillance of work-related burns is crucial to the recognition and prevention of these conditions. In the first year of Michigan's work-related burns surveillance system, seven worksites were identified by the surveillance data where a subsequent intervention by Michigan OSHA likely reduced burn risks to other employees. The number of follow up investigations in this first year was small, partially limited by the delay in identifying and confirming the burn and then referring to Michigan OSHA for follow up. However, those investigations performed in this first year identified major correctable problems. One modification in the surveillance system is to require hospitals to report every 3 months rather than once a year to increase the timeliness of reports so as to increase efficacy of follow up investigations. A second modification is to lower the reporting requirement from age 16 to age 14 in order to capture burn injuries among working teens, a group that frequently works in food services, the industry with the highest burn rate in Michigan's 2009 data. Finally, we will collect data on the source of payment listed in the medical records in order to assess how frequently workers' compensation was listed as the payer for work-related burns.

In addition to strengthening the worksite intervention component of the system, we plan to develop educational materials including hazard alerts where we see patterns in causes for the burns.

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