Work-Related Burns in Michigan: Fourth Annual Report 2013

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Work-Related Burns in Michigan:

Fourth Annual Report

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and

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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 fourth annual report on occupational burns in Michigan; it covers the year 2013. These are the key findings: Work-related burns were identified through multiple reporting sources:

- There were 1,828 work-related burns including seven deaths. Because three individuals each had two or more separate burn incidents, 1,824 individuals were burned at work.
- The employer based survey system administered by the Bureau of Labor Statistics (BLS) estimated 540 work-related burns in 2013.
- The BLS employer based system estimate of work-related burns was 540(29.5%) of the total number of work-related burns identified in 2013 in Michigan's multi-source surveillance system.
- The most common type of medical encounter was an emergency department visit, 1417 of the 1828 burns (77.5%).
- More than one-third, 622 (34.0%), of all work-related burns were among Caucasians and 1195 (65.4%) of work-related cases were among male workers.
- The most common part of the body burned were wrists and hands, 622 (34.0%), and upper limbs except wrists and hands, 372 (20.4%).
- Second degree, 940 (57.8%) and thermal, 1289 (74.7%) burns were the most common types of work-related burns.
- Accommodation and Food Services industry accounted for 30.9% of burns in all age groups and more than half of all work-related burn injuries in young workers aged 14-24, 251(56.2%).
- Workers' Compensation was the expected payer in 929 (56.2%) of the 1,653 cases for which there was a medical record. Payer source could not be determined for 175 (10.6%) medical records reviewed.
- The MIOSHA program completed inspections at 71 worksites identified by the surveillance system where individuals were burned. MIOSHA issued 153 violations and assessed $279,275 in fines.

BACKGROUND

This is the fourth annual report on occupational burns in Michigan. It covers burns that occurred in 2013. 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 Health and Human Services (MDHHS) or a local health department. This work-related burn 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, BLS, the official source of work-related injury statistics, reported 540 work-related burns in 2013 (incidence rate of 29.0 workers 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.

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 a case meets designated criteria, the Michigan Occupational Safety and Health Administration (MISHOA) may decide to conduct a workplace investigation.

DATA SOURCES AND METHODS

There were four reporting sources of work-related burns:

- Hospitals/Emergency Departments
- Workers' Compensation Agency (WCA)
- Poison Control Center (PCC)
- Michigan Fatality Assessment and Control Evaluation (MIFACE)[4]

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 14 years or older receiving medical treatment at a Michigan hospital/ED for whom: (a) a burn-related diagnosis was the primary or secondary code 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.

The WCA provided access to the database of paid claims for wage replacement. Individuals are eligible for wage replacement when they have had at least seven consecutive days away from work including weekends. 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 a work-related burn that occurred in 2013.

A case identified through Michigan's PCC was defined as an individual for whom a call was made by a burned employee, family member, coworker, or healthcare provider, regarding a consultation for a work-related burn injury in 2013.

A case identified through the MIFACE program was identified as an individual who died from a work-related burn in 2013.

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, source of payment, 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 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 available from the duplicate data source.

Individuals whose workplaces could not be identified in the records and whose case met the criteria for a possible MIOSHA inspection (See pg.22) 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, and industry were calculated using the U.S. Census, Department of Labor's Current Population Survey for denominators.[5]

The BLS' Occupational Injuries and Illnesses and Fatal Injuries Profiles online tool was used to generate the 2013 BLS estimates and incidence rates of the number of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and nature of condition for both private and public ownerships.[2] Code 15XXXX (Burns and corrosions) was used.

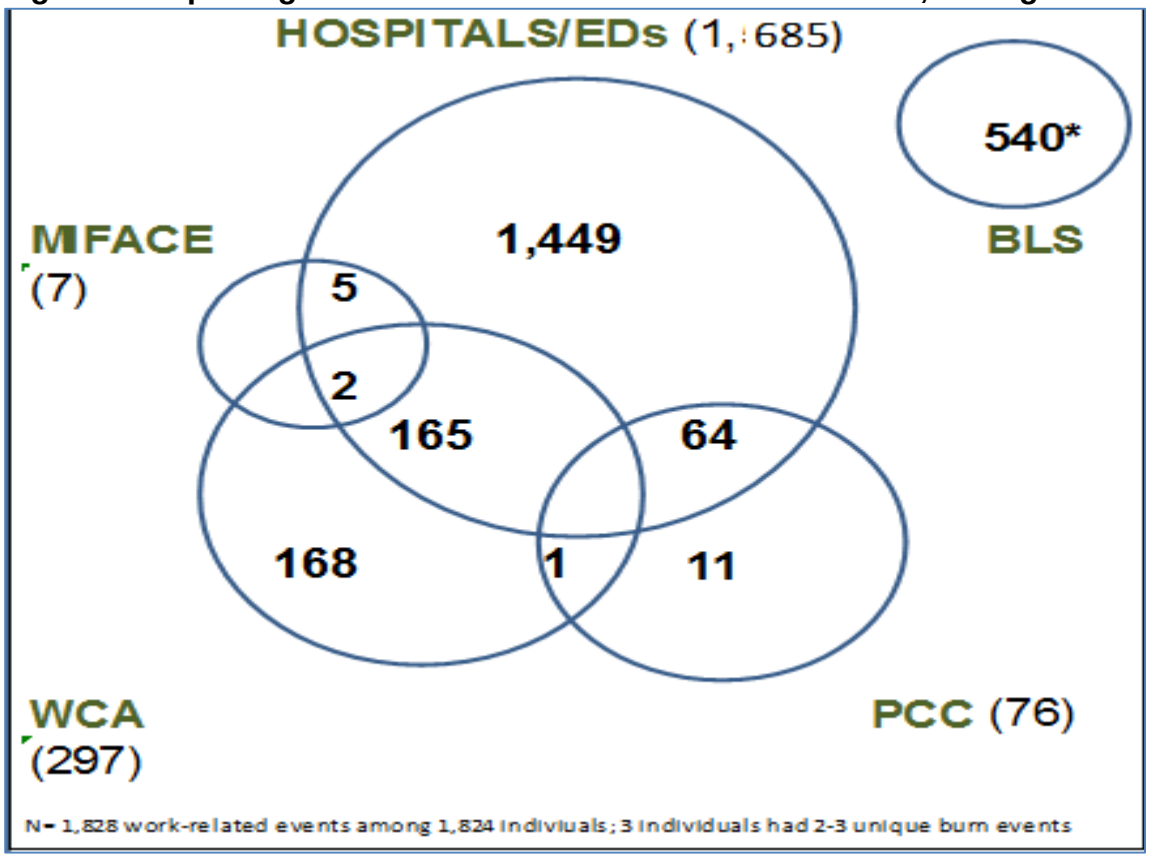
RESULTS

There were 1,828 work-related burn incidents in 2013 reported from hospital/ED, PCC, WCA, and the MIFACE surveillance programs. The 1,828 events represent 1,824 individuals because 3 individuals each had two or more unique burn injuries in 2013.

Reporting Sources

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

Figure 1: Reporting Sources of Work-Related Burn Incidents, Michigan 2013



*There is presumably overlap between the 540 estimates of the BLS and the Michigan reporting sources (HDC, MIFACE and WCA) but BLS does not allow access to their data to assess the degree of overlap.

In 2013, Hospital/ED reports identified 1,685 cases, WCA 297 cases, PCC 76 cases, and MIFACE 7 fatalities. Hospital/ED reports matched 165 WCA reports, 64 PCC reports and 7 MIFACE reports. Two fatalities were identified through the MIFACE program, Hospitals/ED, and WCA, the other five through the MIFACE program and hospital/ED.

One burn case was identified by hospital/ED, a WCA, and PCC data source. Because of confidentiality restrictions, no attempt was made to match our data set with the BLS data set.

Of the 297 WCA cases, 267 were identified because they had been classified as a burn (a thermal burn (245) or a chemical burn (22)). The other 30 were included because they matched with names from one or more of the other data sources, although they had an injury description in the WCA database as something other than “burn”. All records were identified after matching with a burn report from a hospital/ED record. The descriptions in WCA for these 30 were: 4“multiple injuries”,5“unclassified”, 5 “strains/sprains” 3 “electric shock”, 1“ crush/contusion”, 2 “hernia”, 7 “cut/laceration”, 2 “ill-defined”, 1 “skin conditions”.
An emergency department visit was the most common type of medical encounter in 2013, 1,417 (77.5%) cases (Table 1).

Table 1: Work-Related Burns by the Type of Medical Encounter, Michigan 2013

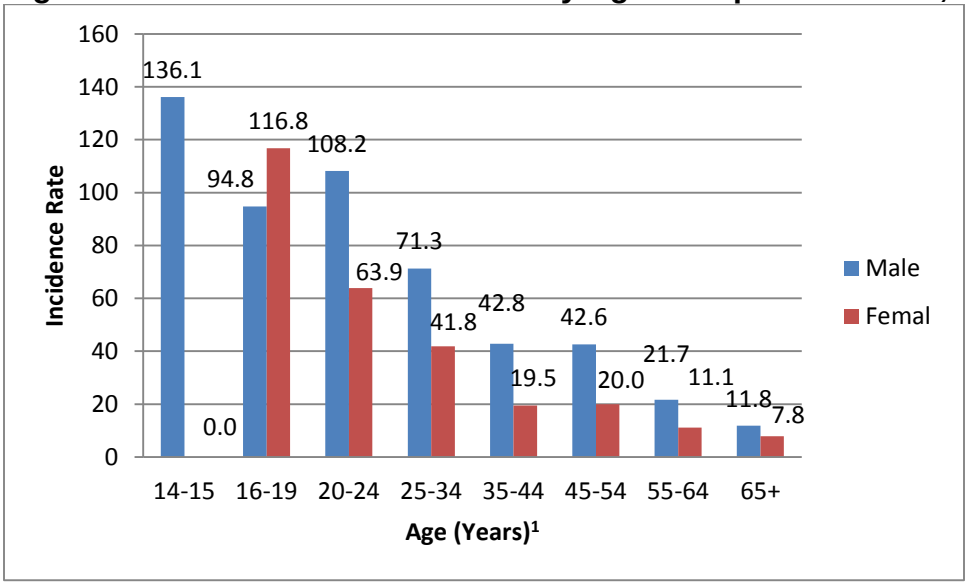
Medical Encounter Type	2013	
	Number	**Percent**
Emergency Department	1,417	77.5
Hospitalization	64	3.5
Outpatient	40	2.2
Other	85	4.6
Unknown	222	12.1
Total	**1,828**	**100.0**

Characteristics of Injured Workers

Age and Gender

Age was available for 1,777 (97.4%) of 1,824 workers in 2013; age was unknown for 21 males, 25 females, and one unknown gender. The age of injured workers ranged from 15 to 84 years. The average age was 34.5. The median age was 31. More than one quarter of burned individuals (518; 28.4%) were identified in the 15-24 age group. One thousand one hundred and ninety-five (65.5%) of all work-related burns in 2013 were among men and 628 (34.4%) were among females. Figure 2 displays burn rates by age group and gender for 2013. Among males, rates were highest for workers aged 14-15 (136.1/100,000). For females, the age group with the highest burn rate was 16-19 (116.8/100,000).

Figure 2. Work-Related Burn Rates by Age Group and Gender, Michigan 2013*



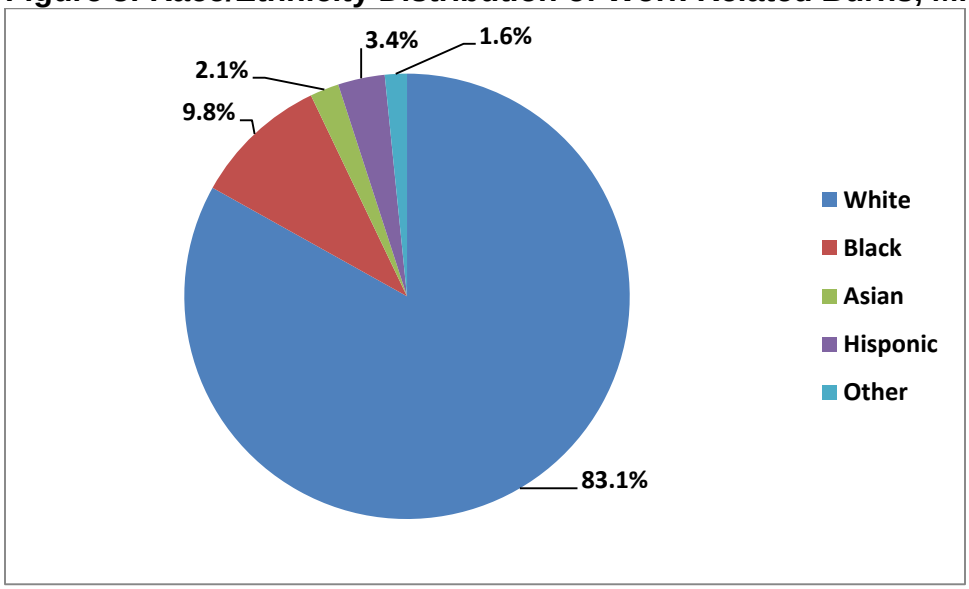
*Rates are the number of workers sustaining a burn per 100,000 workers (number of workers employed by age group used to calculate rates: Bureau of Labor Statistics' Current Population Survey). [6, 7]

[1]Information on age was missing for 21 males, 25 females, and one unknown gender.

Race and Ethnicity

Race and ethnicity of injured workers is shown in Figure 3. Of the workers for whom race was available, 910 in 2013, Caucasians accounted for 756 (83.1%), African-Americans 89 (9.8%), Hispanics 31 (3.4%), Asians 19 (2.1%) and individuals whose race was classified as "Other" for 15 (1.6%). Race and ethnicity information was unavailable for 914 (50.1%) workers.

Figure 3: Race/Ethnicity Distribution of Work-Related Burns, Michigan 2013*



*Race/Ethnicity information available for 910 (49.9%).

Part of Body Injured

Medical records specified the part of body burned and were classified by ICD-9 codes (940.0-.9 – 949.0-.5). Medical records, which included ICD-9 codes regarding Accidents Caused by Fire, were recoded into the ICD-9 codes 940.0-.9 – 949.0-.5, which specify the part of body burned. The Workers' Compensation database did not classify injuries by ICD-9 codes but specified the part of the body burned, which was then recoded into the ICD-9 codes. In the PCC reports, the part of the body injured was specified by the caller and coded by using the ICD-9 codes.

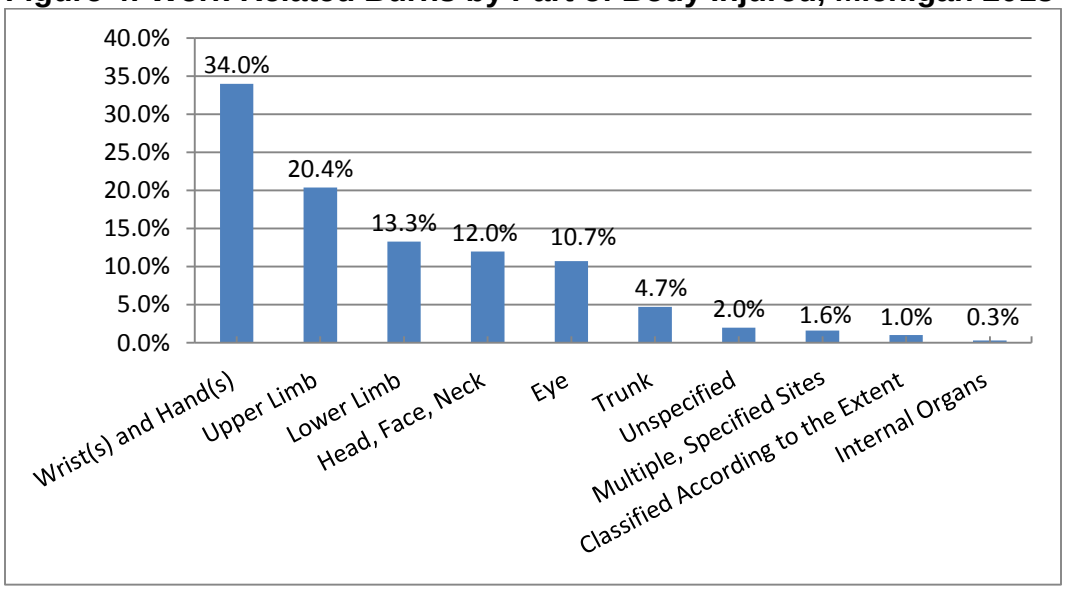
Table 2 and Figure 4 illustrate part of body burned. Burns of wrist(s) and hand(s) occurred most often (34.0%) followed by upper limb burns (20.4%), and then lower limb burns (13.4%).

Table 2: Work-Related Burns by Part of Body Injured, Michigan 2013*

Part of Body Burned (ICD-9 Code)	2013	
	Number	Percent
Eye (940.0-.9)	196	10.7
Head, Face, Neck (941.0-.5)	219	12.0
Trunk (942.0-.5)	86	4.7
Upper Limb (943.0-.5)	372	20.4
Wrist(s) and Hand(s) (944.0-.5)	622	34.0
Lower Limb (945.0-.5)	244	13.3
Multiple, Specified Sites (946.0-.5)	29	1.6
Internal Organs (947.0-.9)	5	0.3
Classified According to the Extent of Body Surface (948.0-.9)[1]	18	1.0
Unspecified (949.0-.5)	37	2.0
Total	**1,828**	**100.0**

*Numbers and percentages are based on a burn-related primary diagnosis of 1,828 burns events in 2013.
[1]This category is used when the site of the burn is unspecified, or with categories 940-949 when the site is specified and the percent of body surface burned is recorded.

Figure 4: Work-Related Burns by Part of Body Injured, Michigan 2013*



*Percentages based on a burn-related primary diagnosis of 1,828 burns events in 2013.

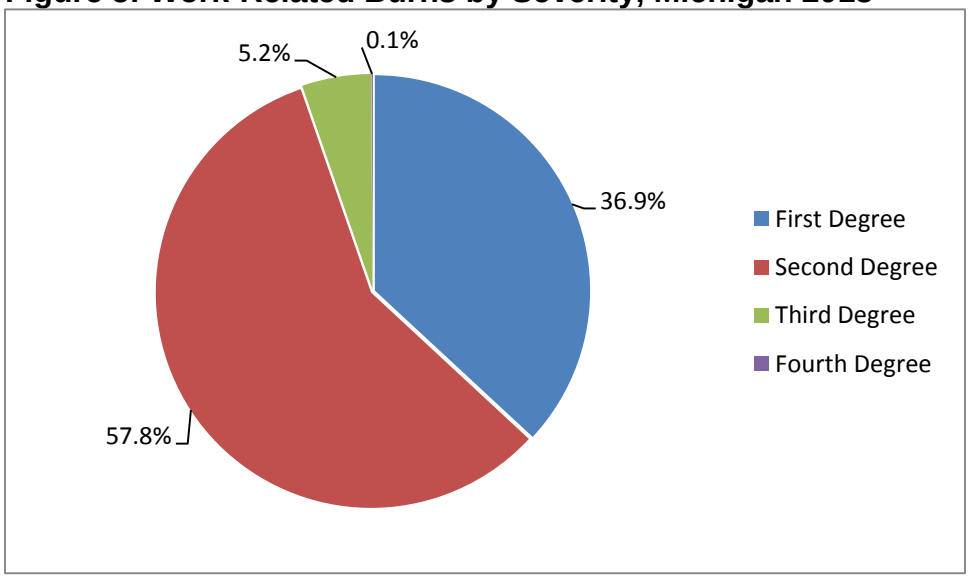
Severity

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 1,626 (88.9%) burns events in 2013 and its distribution is illustrated in Figure 5. A second degree burn was reported in 940 events, which was the most common type of burn, followed by a first degree burn in 600 events, a third degree burn in 85 events, and a fourth degree burn in 1 event. Percentage of body injured was largely unreported. It was specified for only 361 (19.8%) workers, of whom 39 (10.8%) individuals sustained burns to more than 10 percent of their total body surface area.

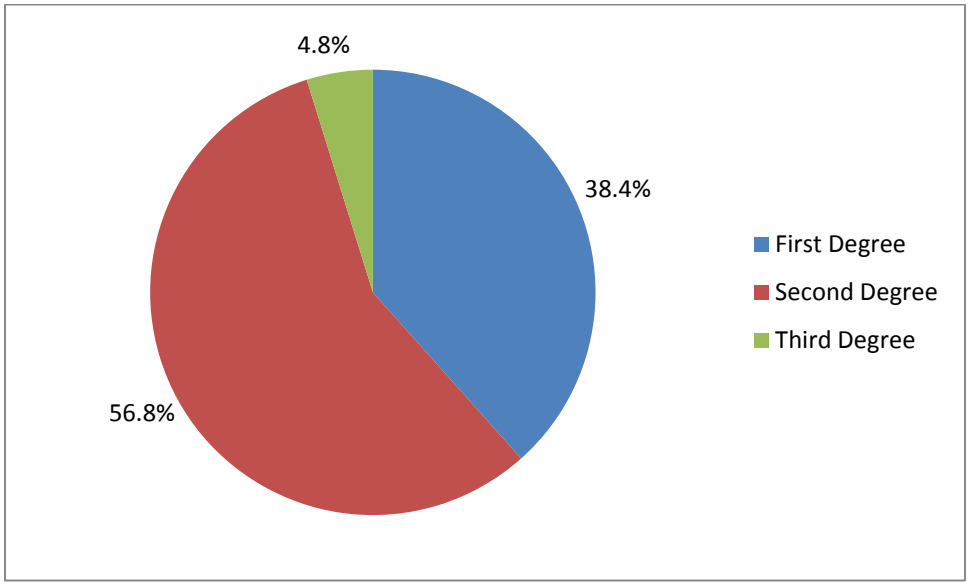
Figure 5: Work-Related Burns by Severity, Michigan 2013*



*Degree of burn was specified for 1,626 of 1,828 burns events in 2013

Figure 6 illustrates severity of burns within young workers aged 14 to 24. Degree of burn was specified for 484 (93.4%) individuals in 2013. Two hundred and seventy five young workers had a second degree burn, followed by a first degree burn in 186 young workers, a third degree burn in 23 young workers.

Figure 6: Work-Related Burns Among Young Workers by Severity, Michigan 2013*



*Degree of burn was specified for 484 young workers in 2013.

County of Residence

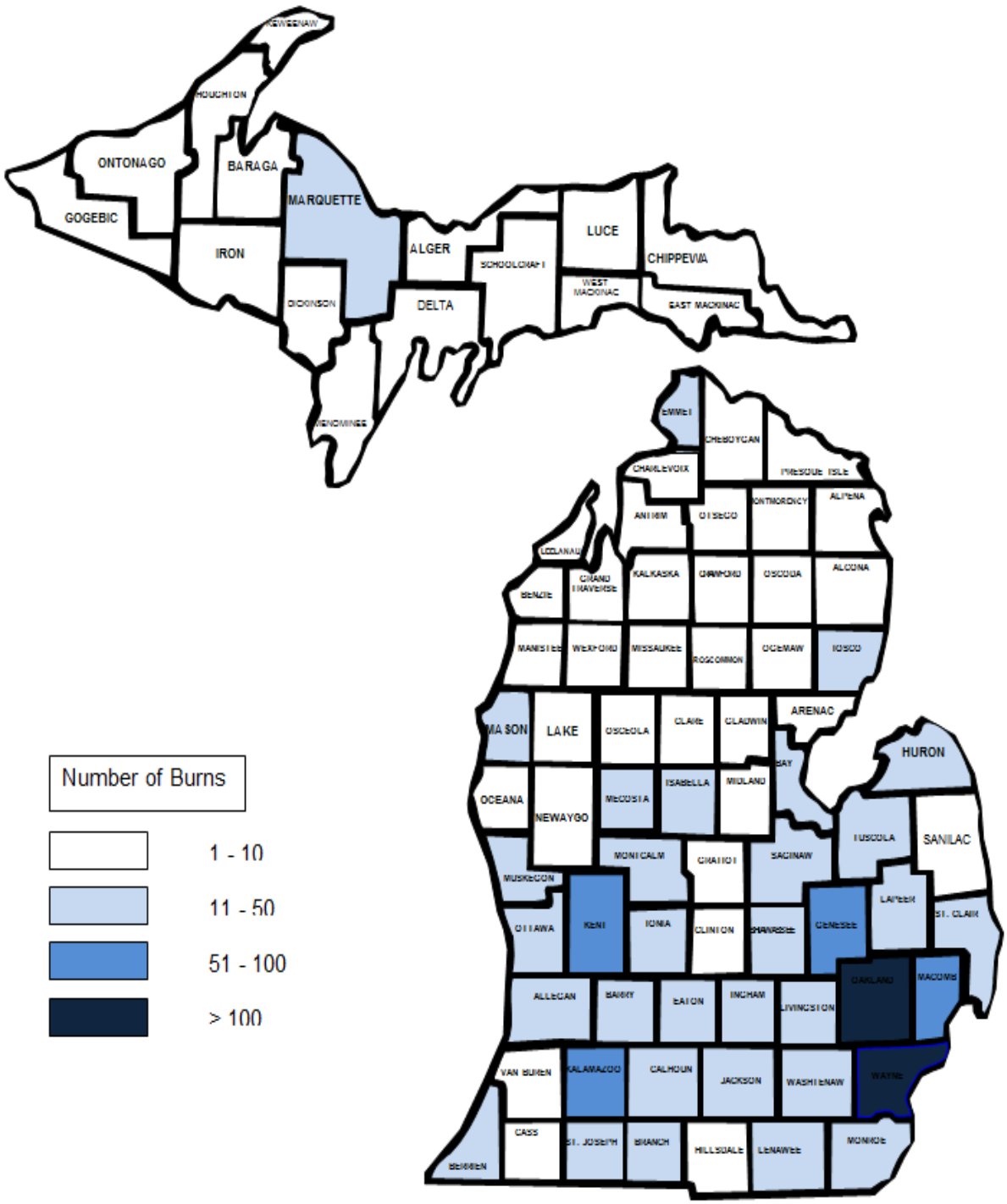
Table 3 and Figures 7 illustrate the worker's county of residence. There were 1,552 (85.1%) Michigan residents for whom the county of residence was known. There were 26 out-of-state workers. County of residence was unknown for 246 Michigan residents. It should be noted that the county of residence would not necessarily be the same county where the individuals were injured. Wayne County had the highest number of residents who sustained a work-related burn with 222 (14.3%) cases, followed by 141 (9.1%) cases in Oakland county, and then Macomb county with 86 (5.5%) cases.

Table 3: Individuals with Work-Related Burns by County of Residence, Michigan 2013

County	Number	Percent	County	Number	Percent
Alcona County	3	0.2	Lake County	4	0.3
Alger County	4	0.3	Lapeer County	18	1.1
Allegan County	13	0.8	Leelanau County	1	0.1
Alpena County	10	0.6	Lenawee County	20	1.3
Antrim County	1	0.1	Livingston County	35	2.2
Arenac County	3	0.3	Luce County	2	0.1
Baraga County	3	0.3	Mackinac County	7	0.5
Barry County	15	1.0	Macomb County	86	5.5
Bay County	20	1.3	Manistee County	5	0.3
Benzie County	6	0.4	Marquette County	23	1.4
Berrien County	20	1.3	Mason County	14	0.9
Branch County	11	0.7	Mecosta County	13	0.8
Calhoun County	30	1.9	Menominee County	1	0.1
Cass County	1	0.1	Midland County	7	0.5
Charlevoix County	2	0.1	Missaukee County	5	0.3
Cheboygan County	7	0.5	Monroe County	36	2.3
Chippewa County	7	0.5	Montcalm County	25	1.6
Clare County	9	0.6	Montmorency County	3	0.2
Clinton County	8	0.5	Muskegon County	42	2.7
Crawford County	6	0.4	Newaygo County	7	0.5
Delta County	10	0.6	Oakland County	141	9.1
Dickinson County	10	0.6	Oceana County	7	0.5
Eaton County	20	1.3	Ogemaw County	1	0.1
Emmet County	11	0.7	Ontonagon County	1	0.1
Genesee County	61	3.9	Osceola County	6	0.4
Gladwin County	6	0.4	Oscoda County	2	0.1
Gogebic County	2	0.1	Otsego County	5	0.3
Grand Traverse County	9	0.6	Ottawa County	43	2.7
Gratiot County	8	0.5	Presque Isle County	3	0.3
Hillsdale County	3	0.3	Roscommon County	2	0.1
Houghton County	3	0.3	Saginaw County	18	1.1
Huron County	13	0.8	St. Clair County	22	1.4
Ingham County	49	3.1	St. Joseph County	16	1.0
Ionia County	22	1.4	Sanilac County	9	0.6
Iosco County	4	0.3	Schoolcraft County	2	0.1
Iron County	4	0.3	Shiawassee County	17	1.0
Isabella County	16	1.0	Tuscola County	17	1.0
Jackson County	38	2.5	Van Buren County	7	0.5
Kalamazoo County	64	4.1	Washtenaw County	35	2.2
Kalkaska County	10	0.6	Wayne County	222	14.3
Kent County	69	4.4	Wexford County	9	0.6
Keweenaw County	2	0.1	**Total**	**1552***	**100.0**

*There were another 246 individuals where county of residence was unknown and another 26 who resided out of state

Figure 7: Individuals with Work-Related Burns by County of Residence, Michigan 2013



Total number of Individuals: 1,552
Out of state Individuals: 26
County was unknown for 246 Individuals

Industry

Table 4 illustrates the number, percent and rate of work-related burns by industry. For the 1,557 (85.2%) individuals in 2013, there was sufficient information for industry classification using the North American Industry Classification System (NAICS) industry codes. Twenty-five workers were self-employed. Accommodation and Food Services (two-digit NAICS industry sector 72) had the highest number of work-related burns with 481 (30.9%) cases, followed by the Health Care and Social Assistance sector (NAICS 62) with 162 (10.4%) burns, and the Primary Metal Manufacturing sector (NAICS 33), which had 161 (10.3%) burns. These three sectors combined accounted for more than half of all work-related burns for 2013 surveillance, representing 51.6%. 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 (167.8 per 100,000 workers) of burns, followed by Mining, Quarrying, and Oil and Gas Extraction (84.5 per 100,000 workers), and Food, Beverage and Textile Manufacturing industry (80.4 per 100,000 workers). Table 5 illustrates the number, percent and rate of work-related burns by industry within young workers aged 14 to 24. Accommodation and Food Services industry accounted for more than half of all work-related burns, 56.0%. Accommodation and Food Services industry had also the highest rate (204.1 per 100,000) among young workers.

Table 4: Work-Related Burns by Industry, Michigan 2013

Industry Classification (NAICS)	2013		
	Number	Percent	Rate*
Accommodation and Food Services (72)	481	30.8	167.8
Primary Metal Manufacturing (33)	161	10.3	39.9[1]
Health Care and Social Assistance (62)	162	10.4	25.9
Construction (23)	80	5.1	38.6
Wholesale Trade (42)	72	4.6	71.5
Administrative and Support and Waste Management and Remediation Services (56)	72	4.6	44.1
Public Administration (92)	69	4.5	49.5
Wood Products/ Paper/ Petroleum and Coal Products Manufacturing (32)	68	4.4	51.8[1]
Other Services (except Public Administration) (81)	65	4.2	29.6
Retail Trade (44)	79	5.1	23.9[2]
Food, Beverage, Textile Manufacturing (31)	46	3	80.4[1]
Educational Services (61)	47	3	13.0
Arts, Entertainment, and Recreation (71)	24	1.5	23.8
Sporting Goods, Hobby, Book, and Music Stores (45)	12	0.8	9.3[2]
Professional, Scientific, and Technical Services (54)	31	2.0	12.3
Transportation and Warehousing (48-49)	29	1.9	18.3
Agriculture, Forestry, Fishing and Hunting (11)	13	0.8	23.6
Real Estate and Rental and Leasing (53)	14	0.9	21.1
Mining, Quarrying, and Oil and Gas Extraction (21)	4	0.3	84.5
Utilities (22)	15	1	11
Finance and Insurance (52)	10	0.6	2.2
Information (51)	3	0.2	5.5
Total of All Burns	**1557**	**100**	**42.4**

*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).[5]

**Sufficient information for industry classification was available for 1,557 individuals in 2013.

[1]The denominator for this rate does not include 11,777 individuals in 2013 from "Not specified manufacturing industries (Part of 31, 32, and 33)" because the rate of burns was calculated separately for NAICS 31, 32, and 33. These are 80.45%, 51.8%, and 39.9%, respectively for workforce with NAICS 31, 32 and 33.

[2]The denominator for this rate does not include 7,679 individuals in 2013 from "Not specified retail trade (Part of 44, 45)" because the rate of burns was calculated separately for NAICS 44 and 45. These are 23.9% and 9.3%, respectively of workforce with NAICS 44 and 45.

Table 5: Work-Related Burns Among Young Workers (14-24) by Industry, Michigan 2013

Industry Classification (NAICS)	2013		
	Number	Percent	Rate*
Accommodation and Food Services (72)	251	56.2	204.1
Health Care and Social Assistance (62)	28	6.3	47.2
Primary Metal Manufacturing (33)	25	5.6	76.1[1]
Retail Trade (44)	25	5.6	37.9[2]
Construction (23)	14	3.1	67.0
Administrative and Support and Waste Management and Remediation Services (56)	17	3.8	142.5
Food, Beverage, Textile Manufacturing (31)	9	2.0	232.1[1]
Other Services (except Public Administration) (81)	14	3.1	39.8
Sporting Goods, Hobby, Book, and Music Stores (45)	2	0.4	6.7
Wood Products/ Paper/ Petroleum and Coal Products Manufacturing (32)	11	2.5	60.6
Arts, Entertainment, and Recreation (71)	8	1.8	27.1
Public Administration (92)	5	1.1	51.5
Wholesale Trade (42)	10	2.2	145.9
Educational Services (61)	9	2.0	23.9
Professional, Scientific, and Technical Services (54)	6	1.3	19.1
Agriculture, Forestry, Fishing and Hunting (11)	4	0.9	25.0
Transportation and Warehousing(48-49)	4	0.9	58.6
Finance and Insurance (52)	2	0.4	10.4
Real Estate and Rental and Leasing (53)	3	0.7	41.3
Total of All Burns	**447**	**100**	**92.2**

*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).[5]

**Sufficient information for industry classification was available for 447 individuals in 2013.

[1]The denominator for this rate does not include 280 individuals from "Not specified manufacturing industries (Part of 31)" because the rate of burns was calculated separately for NAICS 31. This is 232.1% of workforce with NAICS 31.

[2]The denominator for this rate does not include 6,467 individuals in 2011 and 9,344 individuals in 2012 from "Not specified retail trade (Part of 44, 45)" because the rate of burns was calculated separately for NAICS 44 and 45. This is 1.4% and 2.0%, respectively of workforce with NAICS 44 and 45.

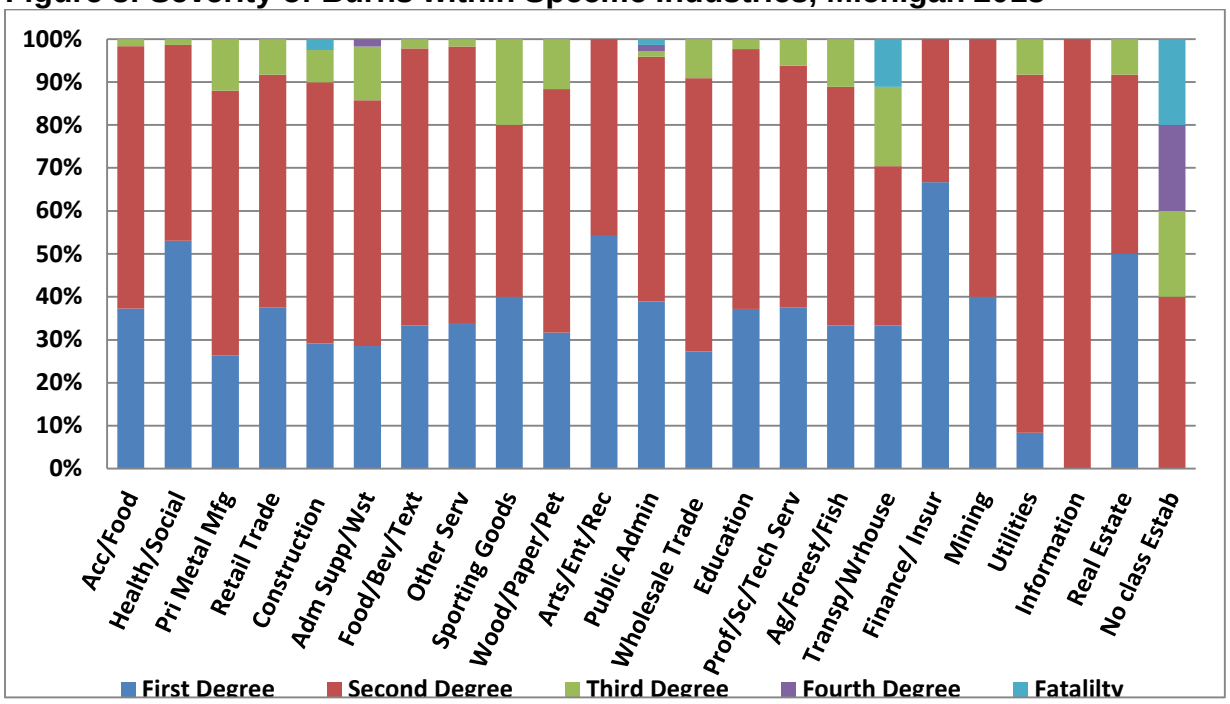
Severity of Burns within Specific Industries

Table 6 and figure 8 illustrates severity of burns within specific industries for 1,394 (76.3%) individuals in 2013 for whom severity of burns was specified. The predominant degree of burn across all industries was second degree in 806(57.8%) individuals. Of the seven fatalities in 2013, two were reported in the Construction (NAICS 23), three were reported in Transportation and Warehousing (48-49), one in the Public Administration sector (92), and one in unknown industry.

Table 6: Severity of Burns within Specific Industries, Michigan 2013

Industry Classification (NAICS)	Degree of Burns					
	1º	2º	3º	4º	Fatal	Total
Accommodation and Food Services (72)	176	288	8	0	0	**472**
Health Care and Social Assistance (62)	78	66	2	0	0	**146**
Primary Metal Manufacturing (33)	33	75	15	0	0	**123**
Retail Trade (44)	27	39	6	0	0	**72**
Construction (23)	23	48	6	0	2	**79**
Administrative and Support and Waste Management and Remediation Services (56)	16	32	7	1	0	**56**
Food, Beverage, Textile Manufacturing (31)	15	29	1	0	0	**45**
Other Services (except Public Administration) (81)	19	36	1	0	0	**56**
Sporting Goods, Hobby, Book, and Music Stores (45)	2	2	1	0	0	**5**
Wood Products/ Paper/ Petroleum and Coal Products Manufacturing (32)	19	34	7	0	0	**60**
Arts, Entertainment, and Recreation (71)	13	11	0	0	0	**24**
Public Administration (92)	28	41	1	0	1	**72**
Wholesale Trade (42)	15	35	5	0	0	**55**
Educational Services (61)	16	26	1	0	0	**43**
Professional, Scientific, and Technical Services (54)	6	9	1	0	0	**16**
Agriculture, Forestry, Fishing and Hunting (11)	3	5	1	0	0	**9**
Transportation and Warehousing(48-49)	9	10	5	0	3	**27**
Finance and Insurance (52)	4	1	0	0	0	**5**
Mining, Quarrying, and oil and Gas Extraction(21)	2	3	0	0	0	**5**
Utilities(22)	1	10	1	0	0	**12**
Information(51)	0	1	0	0	0	**1**
Real Estate and Rental and Leasing (53)	6	5	1	0	0	**12**
Total of All Burns	**511**	**806**	**70**	**3**	**6**	**1394**

Figure 8: Severity of Burns within Specific Industries, Michigan 2013



Month of Injury

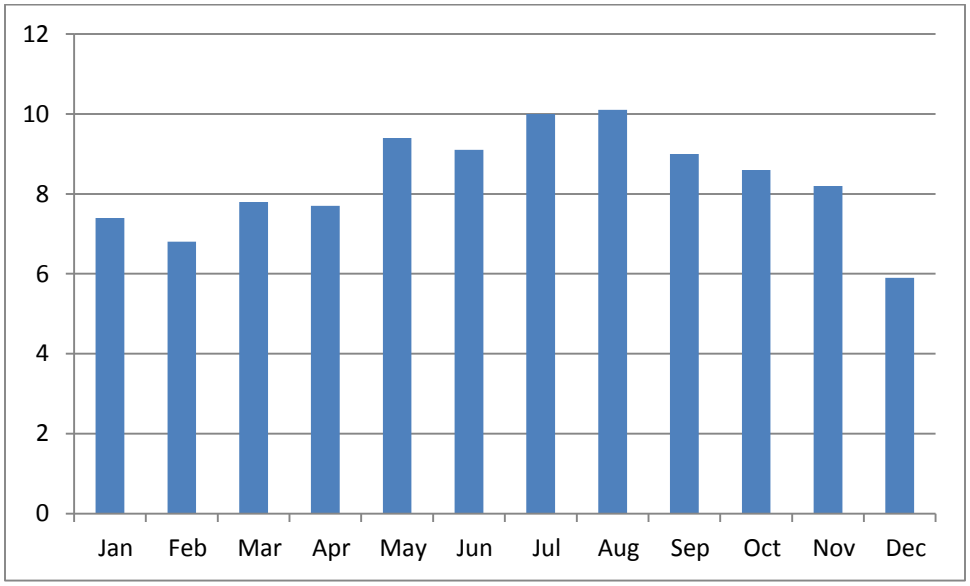
Month of injury was known for all but 77 individuals in 2013 (Table 7 and Figure 9). The most common months for a burn occurred in July and August, with 175 (10.0 %) and 177 (10.1 %) cases respectively. The lowest number occurred in December, with 103 (5.9 %).

Table 7: Work-Related Burns by Month of Injury, Michigan 2013

Month of Injury	Number	Percent
January	130	7.4
February	118	6.7
March	137	7.8
April	135	7.7
May	164	9.4
June	159	9.1
July	175	10.0
August	177	10.1
September	158	9.0
October	151	8.6
November	144	8.2
December	103	5.9
Total	**1751**	**100**

*Month of injury was known for 1751(95.8%) of 1828 burns events.

Figure 9: Percentage of Work-Related Burns by Month of Injury, Michigan 2013



Source of Payment

Workers' Compensation was the expected payer in 929 (56.2%) of the 1,653 cases for which there was a medical record in 2013 (Table 8). One hundred and eight of these 929 (19.3%) received wage replacement for more than seven days away from work. For 175 cases, payment source could not be identified. Of the 724 cases

for which Workers' Compensation was not listed as a payment source in medical records, 18 were matched to a case in the Workers' Compensation claims database. All the 18 cases were also classified as a burn in the Worker Compensation data base.

Table 8: Work-Related Burns by Payment Source, Michigan 2013

Expected Source of Payment	2013			
	Total		Non-Self-Employed	
	Number	Percent	Number	Percent
Workers' Compensation	929	56.2	929	57.0
Commercial Insurance	178	10.8	164	10.1
Self-Pay	129	7.8	123	7.6
Other	178	10.8	174	10.7
Not Specified	239	14.5	239	14.7
Total	**1,653**	**100**	**1,629**	**100**

Data Source: Michigan hospital/ED medical records

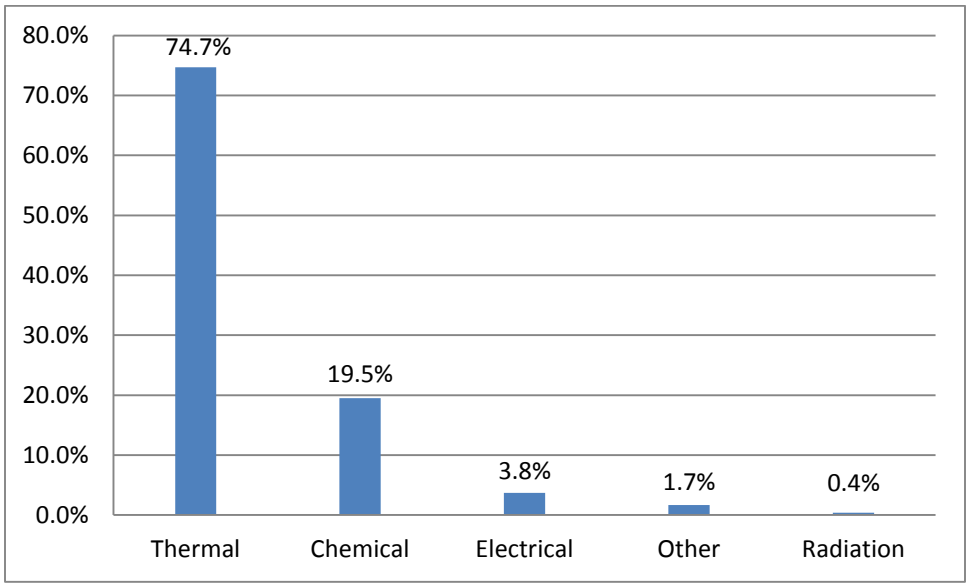
Causes of Burns

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, and 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.

Burn type was specified for 1,726 (94.4%) events in 2013. The predominant burn type was thermal in 1,289 (74.7%) events, followed by chemical in 336 (19.5%) events, electrical in 65 (3.8%) events, and radiation in 7(0.4%) events (all from exposure to ultraviolet rays from welding). Some of the kinds of chemicals involved in chemical burns included sulfuric acid, sodium hydroxide, nitric acid, phosphoric acid and iodine. Among hospitalized cases (n= 64), thermal exposure was the cause for 46 (71.9%), chemical for 6 (9.4%) and electrical for 9 (14.1%) of the burns.

Figure 10: Work-Related Burn Type, Michigan 2013*



*Burn type specified for 1,726 burns events in 2013.

Referrals to MIOSHA

The MIOSHA referral criteria for a work-related burn that occurred in 2013 was that the individual had to have (1) been hospitalized, treated in an ED or treated as an outpatient, (2) sustained at least a second degree burn, and (3) the burn had to have taken place within six months of the referral.

Table 9 illustrates the distribution of violations and penalties assessed by the industry type of the inspected workplaces in 2013.

Table 9: Workplaces Inspected by MIOSHA: Violations and Penalties Assessed by Industry, Michigan 2013

Industry Classification (NAICS)	2013		
	# of Enforcement Inspections	# of Violations	Total Penalties Assessed*
Mining, Quarrying, and oil and Gas Extraction(21)	1	0	$0
Construction (23)	5	4	$4,475
Food, Beverage, Textile Manufacturing (31)	9	16	$14,150
Wood Products, Paper, Petroleum and Coal Products Manufacturing (32)	10	13	$10,550
Primary Metal Manufacturing (33)	15	31	$55,050
Wholesale Trade (42)	10	26	$17,150
Retail Trade (44)	3	10	$8,350
Sporting Goods, Hobby, Book and Music Stores (45)	1	1	$1,250
Professional, Scientific, and Technical Services (54)	1	3	$4,800
Administrative and Support and Waste Management and Remediation Services (56)	1	2	$1,500
Arts, Entertainment, and Recreation (71)	2	13	$4,100
Accommodation and Food Services (72)	11	31	$14,900
Other Services (Except Public Administration) (81)	1	3	$143,000
Public Administration (92)	1	0	0
Total	**71**	**153**	**$279,275**

*These totals are for all violations found during the inspection, not limited to only burn related issues.

Examples of Work-Related Burn MIOSHA Enforcement Inspections

In adequate Guarding

- A male in his late thirties, sustained second degree burns as a result of slipping and stepping into basin full of caustic/corrosive substance. MIOSHA found 15 violations (14 “Serous” and 1 “Other”), including “Citation 1 Item 1: Walking access planks are not slip resistant; Citation 1 Item 2: Not enforcing lockout for employees entering a permit-required confined space to perform maintenance and servicing activities; Citation 1 Item 3: No lockout training for authorized employees who enter a permit-required confined space to perform maintenance and servicing activities that require lockout; Citation 1 Item 4a : No sign or other effective means to notify employees of permit-required confined space dangers; Citation 1 Item 4b: Inadequately written and implemented permit-required confined space program; Citation 1 Item 5a: no hazard evaluation of the permit-required confined spaces the employees enter; Citation 1 Item 5b: No policies and procedures developed and implemented for employees who enter permit-required confined space; Citation 1 Item 5c : Equipment required to enter a permit-required confined space was not made available and the use of the equipment available to employees was not utilized; Citation 1 Item 5d : No air monitoring conducted before permit-confined space entry was conducted; Citation 1 Item 5e : No periodic continuous air monitoring conducted during a permit-required confined space entry; Citation 1 Item 5f: Employees who participated in a confined space entry did not have active roles designated; Citation 1 Item 5g: inadequate rescue procedures developed; employer does not have employees trained to performed rescue and has not designated on outside rescue service in the written program ; Citation 1 Item 6: No confined space entry permit, employees entered a permit-required confined space to clear a line wreck; Citation 1 Item 7: No training provided to employees who entered a permit-required confined space; Citation 2 Item 1: The injury and illness logs were not made available during the initial opening conference and inspection.

- A male in his thirties, sustained severe second and third degree circumferential burns to the right leg as a result of stepping into a container or pool of molten metal, resulting in burns to approximately 11.0% of body surface. The employee removed his leg immediately, but found the boot melting off and his pants on fire. Some mild smoke inhalation was reported, associated with the combustion of employee's clothing and other material. Grafting and physical rehabilitation were required. MIOSHA found 3 serious violations, including Citation 1 Item 1: "Inadequate standard barrier, no top rail, inadequate midrail, midrail opening 29x40 inches, caster shop area; Citation 1 Item 2: Unguarded floor grate opening over molten brass container, opening approximately 2x3 feet, caster shop area; Citation 1 Item 3: Inadequate means of egress, employees step over equipment 31-inches above floor, caster launder shop area."

Improper Lockout in Purchased Plastics Resins

- A male in his mid-thirties, sustained third degree burn covering 8.5% of his body surface, as a result of opening a machine from which hot polypropylene exploded onto his face, right arm, chest and abdomen. MIOSHA found 4 serious violations, including Citation 1 Item 1 a: " The use of hand protection not enforced, employee wearing oven glove on one hand only" ; Citation 1 Item 1b: No personal protective equipment assessment performed/documented; Citation 1 Item 2a: Not utilizing and/or enforcing lockout procedure, employee was in the process of opening extrusion machine with the lever to clean the screen, when he was sprayed with hot extruded plastic while still under pressure, single screw extruder, extrusion line 1; Citation 1 Item 2b: No lockout training, employee was in the process of opening extrusion machine with the lever to clean the screen, when was sprayed with hot extruded plastic while still under pressure, single screw extruder, extrusion line 1."

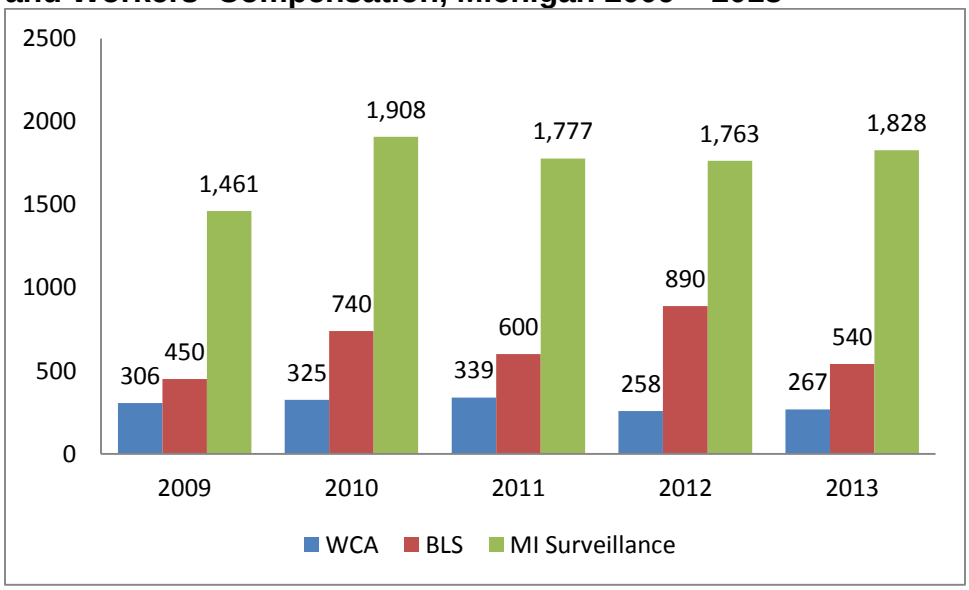
Agriculture Exposure

- A male worker in his mid-twenties sustained severe ultra violet eyes burns as a result of not using personal productive equipment. MIOSHA found 3 serious violations, including Citation 1 Item 1a: Employees assigned to work on air handling chillers, were not provided training on the hazards and proper safeguards when working on or near the associated ultraviolet lights; Citation 1 Item 1b: Employees assigned to work on two different rooms were not provided appropriate personal protective equipment to protect against the hazards of UV light and corrosive chemicals (i.e., anti-UVC safety glasses, chemical splash goggles, face shield, and chemical-resistant apron, etc..); Citation 1 Item 1c: Employees assigned to work on air handling chillers and other room were not provided appropriate personal protective equipment to protect against the hazards of UV light and corrosive chemicals (i.e., anti-UVC safety glasses, chemical splash goggles, face shield, and chemical-resistant apron, etc..)

DISCUSSION

This is the fourth report on work-related burn data in Michigan. It covers 2013. 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 BLS, which is the official source of work-related statistics.[6] The Michigan system identified 1,828, work-related burns sustained by 1,824 individuals, in 2013 in comparison to 540 reported by BLS (Figure 11). The employer-based system estimates account for only 29.5% of all work-related burns in 2013 identified by the Michigan multi-source surveillance system.

Figure 11: Number of Work-Related Burns comparing Two Surveillance Systems and Workers' Compensation, Michigan 2009 – 2013



The BLS's undercount of work-related burns is 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. Based on data from WCA, the Michigan multi-source surveillance system included at least 108 individuals with more than seven days away from work but we do not have data on how many individuals had one to seven days or required a job transfer or restriction. Secondly, the BLS excluded self-employed, independent contractors and farm workers who work on farms with less than 11 employees. Michigan's burn surveillance identified only 25 self-employed and 13 farmers with burns so the

difference in the type of workers covered in the BLS survey does not explain the undercount in the BLS data. Other possible explanations for the BLS undercount may be that employers are not providing complete reporting, 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 or more consecutive days away from work; 2) WCA excluded the self-employed, but again there were only 25 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 9 work-related burns identified from medical records or PCC were classified differently in the WCA data. Presumably, there were other injuries in the WCA database 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 Years 2009-2013 and 2014-2018[7] is to reduce by 20% and 15% the rate of worker injuries and illnesses in high-hazard industries, respectively, 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) and 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 Primary Metal Manufacturing (Table 4)).

Surveillance of work-related burns is crucial to the recognition and prevention of these conditions. The system was modified in 2011 to require the hospitals to report on a quarterly rather than an annual basis. This more timely identification of burns has facilitated an increased number of MIOSHA inspections from three to seven in 2009 and 2010 to 71 and 83 in 2012 and 2013, respectively. A second modification that has been introduced to Michigan's burn surveillance system has been lowering the reporting requirement from age 16 to age 14 in order to capture burn injuries among working teens.

This group frequently works in food services; the industry with the highest burn rate in Michigan's 2009 - 2013 data (Table 6).

In addition to continuing to strengthen the worksite intervention component of the system, we are developing educational materials for distribution to employers and employees where there are patterns in causes for the burns. The first fact sheet developed was on burns from hydrofluoric acid present in cleaners used to wash cars and trucks (8). Development and distribution of this information will allow employers to work with employees to implement controls at more facilities than where a MIOSHA inspection was performed.

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