# Work-Related Burns Michigan 2018

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MICHIGAN STATE UNIVERSITY

Michigan Department of
Labor and Economic Opportunity

# Work-Related Burns in Michigan, 2018

A Joint Report of the

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# EXECUTIVE SUMMARY

The Division of Occupational and Environmental Medicine at Michigan State University (MSU) and the Michigan Department of Health and Human Services (MDHHS) operate a surveillance system for monitoring work-related burns in Michigan. This report describes these injuries for 2018. Key results include:

- Work-related burns were identified through medical records submitted by hospitals and occupational health clinics, poison control center reports, and Workers' Compensation claims. The Michigan Fatality Assessment and Control Evaluation (MIFACE) program did not report any work-related burn deaths for 2018.
- There were 1,865 work-related burns among workers in Michigan, representing a 1.9 percent increase from the previous year.
- The Bureau of Labor Statistics Survey of Occupational Injuries and Illnesses (BLS SOII) estimated that only 980 work-related burns occurred in 2018. The BLS estimate was 47.5 percent lower than the Michigan-based surveillance system.
- Almost two out of three burns (64.5 percent) were among male workers and the rate of work-related burns among males was 64.1 percent higher than the rate among females.
- The most common areas of the body affected were wrists and hands (33.4 percent of all burn injuries in 2018).
- Most (74.7 percent) burns were caused by a thermal exposure. Slightly more than one in five burns (21.2 percent) was caused by a chemical exposure. The remaining 4.1 percent of burns were caused by electrical, radiation, other, or multiple exposures.
- The accommodation and food services industry accounted for the highest percentage (33.8 percent) of work-related burns and the highest rate of work-related burns (160.8 burns per 100,000 workers).
- For work-related burns identified through medical records, Workers' Compensation was the expected payer for medical care in 944 cases. There were an additional 31 work-related burns that received Workers' Compensation wage replacement for lost worktime, but which had another type of health care coverage listed as the expected payer.
- The Michigan Occupational Safety and Health Administration (MIOSHA) program completed inspections at 15 worksites identified by the surveillance system. MIOSHA issued 21 violations and assessed $43,850 in fines related to hazardous conditions at these 15 worksites.

# BACKGROUND

This is the seventh report of occupational burns in Michigan, covering injuries that occurred to Michigan workers in 2018. Occupational burns are a preventable work-related injury and are among the most serious injuries that can occur in a workplace. Health professionals and health facilities are required to report all traumatic injuries, defined as 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, when requested by the Michigan Department of Health and Human Services (MDHHS) or a local health department.[1] This administrative rule supports the surveillance of occupational injuries, including burns, giving MDHHS the authority to mandate reporting of work-related injuries. These reports are used to identify causes of work-related burns, target interventions to reduce the risk of burns, and evaluate the effectiveness of interventions.

The Bureau of Labor Statistics Survey of Occupational Injuries and Illnesses (BLS SOII), which serves as the official source of work-related injury and illness statistics, reported that 980 work-related burns occurred in Michigan in 2018 (incidence rate of 29.0 burns per 100,000 workers).[2] The BLS SOII estimates are based on employer reporting and include private industry and state and local government workers but not the self-employed, independent contractors, or workers employed by farms with fewer than 11 employees.

Michigan State University's Occupational and Environmental Medicine Division operates the burn surveillance system as the bona fide agent for MDHHS. Once a work-related burn diagnosis is confirmed and a case meets specific criteria, the Michigan Occupational Safety and Health Administration (MIOSHA) may decide to conduct a workplace investigation.

# DATA SOURCES AND METHODS

Work-related burn reports for the Michigan work-related burns surveillance system were received from the following sources:

1. Hospital Emergency Departments (ED)
2. Occupational Health Clinics
3. Workers' Disability Compensation Agency (WDCA)
4. Poison Control Center (PCC)
5. Michigan Fatality Assessment and Control Evaluation (MIFACE)[3]

All acute care hospitals in Michigan, including Veterans Administration hospitals, are required to report work-related burns. Medical records were used to identify work-related burns treated at hospital/emergency departments or at a hospital-based outpatient occupational health clinic. Injuries identified through medical records were eligible for inclusion if the injury occurred in Michigan, the individual was 14 years or older at the time of the injury, the medical record included a burn-related International Classification of Diseases, Tenth Clinical Modification (ICD-10-CM) diagnosis code as the primary or secondary diagnosis (see Table 1 for list of included ICD-10-CM codes), and the incident was documented as having occurred at work. When the medical record did not contain enough detail to determine if a burn was work-related, MSU staff attempted to contact the individual by phone to collect this information.

**Table 1: ICD-10-CM Codes Used to Identify Burn Injuries**

| Injury Classification | ICD-10-CM Codes |
|---|---|
| Burn injury (by part of body burned) | T20.00-T20.79, T21.00-T21.79, T22.00-T22.79, T23.00-T23.70, T24.00-T24.79, T25.00-T25.79, T26.00-T26.92, T27.0-T27.7, T28.0-T28.9, |
| Burn injury (by extent of body surface involved) | T30.0, T30.4, T31.0-T31.9, T32.0-T32.9 |

The WDCA provided data on claims for wage replacement. Individuals are eligible for wage replacement if they miss more than seven consecutive days of work, including weekends, due to a work-related injury. Work-related burns identified through WDCA claims were eligible for inclusion if the claim was paid or expected to be paid and the injury occurred in 2018. Work-related burns were identified through the PCC when a call was made regarding a consultation for a work-related burn injury in 2018. The MIFACE program data was queried for any records of Michigan workers who died from a work-related burn during 2018.

Information on the reporting source(s), type of medical visit as indicated by the medical record (inpatient hospitalization, emergency department, hospital outpatient[i], or occupational health clinic), hospital name, date of admission and discharge, patient demographics, city and county of residence, payment source, employer information (name, address, North American Industry Classification System (NAICS) code), injury date and month, mechanism of the injury (type of burn), part(s) of body affected, and percentage of total body surface area burned were abstracted from medical records, PCC reports, and MIFACE reports. Cases were linked to the WCDA database based on a probabilistic match of first and last names, date, month, and year of birth, injury type, social security number, and date, month, and year of injury. The RecordLinkage Package in RStudio, Version 3.6.1 (copyright 2019, RStudio, Inc) was used to perform matching. The distribution of match probability weights was inspected to determine an appropriate threshold for potential links and all potential matches were visually inspected for confirmation. WCDA cases meeting the work-related burn case definition that could not be linked to any case identified from other data sources (i.e., where the WCDA was the only source of the case report) were included as unique cases. Cases identified by more than one reporting source were deduplicated after abstracting information from all data sources.

The cause of injury was classified as either a thermal, chemical, electrical, radiation, or multiple-cause burn based on available descriptive information in the medical record or PCC report. Thermal burns are caused by contact with hot surfaces, flames, or hot liquids. Chemical burns are caused by strong acids, alkalis, detergents, or solvents contacting the skin or eyes. Electrical burns are caused by contact with electric current. Radiation burns are caused by prolonged exposure to ultraviolet light or other sources of radiation such as X-rays.

The area of the body affected by the work-related burn was classified based on the ICD-10-CM code assigned in the medical record. For cases without a specific ICD-10-CM code present in the medical record, an appropriate burn injury ICD-10-CM code was assigned based on the description of the injury. Although the WCDA database does not classify injuries by ICD-10-CM codes, it does specify the affected area of the body. This information was used to assign an appropriate ICD-10-CM burn injury code for cases found only in the WCDA database. For cases

[i] Hospital outpatient visits include patients placed on an observation status.

identified only from PCC reports, the affected body area specified by the caller was translated into an appropriate ICD-10-CM code.

County of residence was abstracted from medical records, if available. For cases with missing information on their county of residence, but which had a record in the WDCA database, county was derived from the zip code of residence listed in the claim. Zip codes were converted to counties using the U.S. Census Bureau 2010 ZIP Code Tabulation Area Relationship Files if the zip code was fully contained within a single county. Cases with a residence zip code that spanned multiple counties were assigned to the "Unknown County" category.

For cases that met criteria for a MIOSHA inspection (see pg. 18) but had no employer or workplace information recorded, the injured workers were contacted by telephone to obtain the missing information. For cases that were reviewed by MIOSHA, the results of the review, including if an inspection was performed, the inspection date, number of violations found, and total fines assessed were also obtained.

Database management was conducted using Microsoft Access. Data analysis was performed using RStudio© software. Incidence rates of work-related burns by age, sex, and industry were calculated using the U.S. Census, Department of Labor's Current Population Survey for denominators.[4] Incidence rates of work-related burns by county of residence were calculated using the U.S. Census, Department of Labor's Local Area Unemployment Statistics for denominators.[5]

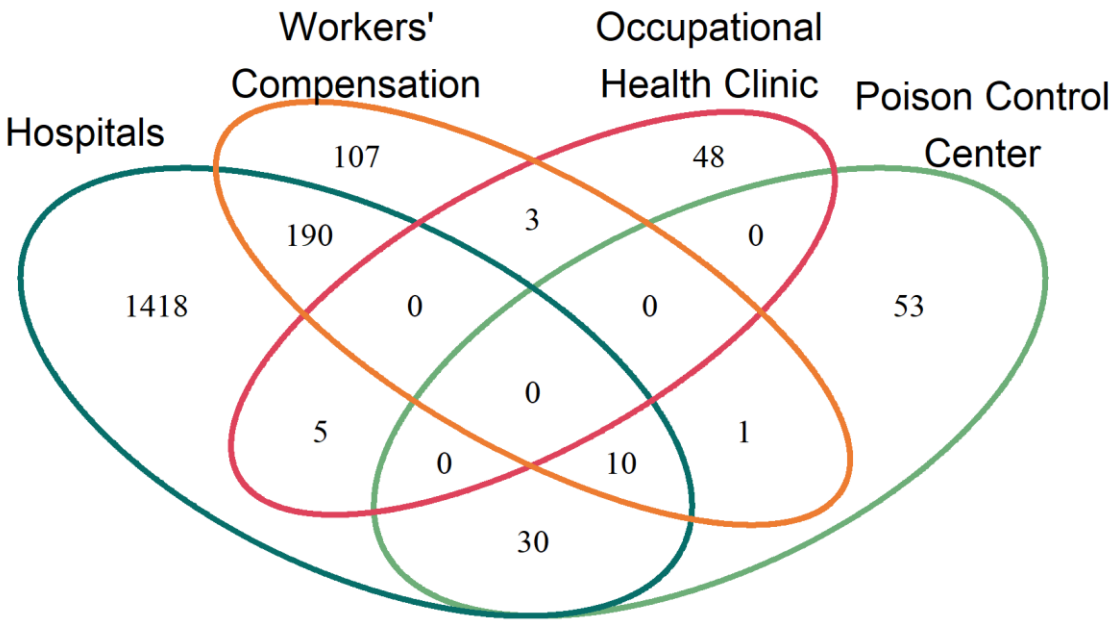
The Michigan work-related burns data were compared to the data from the BLS SOII, which is the nationwide work-related injury/illness surveillance system based on a sample of employers reporting work-related injuries and illnesses in their establishments. The BLS Occupational Injuries and Illnesses and Fatal Injuries Profiles online tool was used to generate numbers and incidence rates of nonfatal occupational burns and corrosions involving days away from work.[2]

# RESULTS

## REPORTING SOURCES

A total of 1,865 work-related burn incidents were identified through the Michigan work-related burns surveillance system in 2018. Of these, 1,836 (98.4 percent) occurred to Michigan residents and 29 occurred to non-Michigan residents. A total of 1,653 cases were identified by hospital-submitted medical charts, 311 cases were identified in the WDCA database, 94 cases were identified from PCC reports, 56 were identified by occupational health clinic medical charts (Figure 1). No work-related burn cases were identified in MIFACE records. The majority (87.2 percent) of cases were identified by a single data source. The remaining 12.8 percent of cases were identified by two or more sources.

**Figure 1: Work-Related Burns by Reporting Source, Michigan 2018**




*Data Source: Michigan work-related burns surveillance system*
*Note: Figure for illustrative purposes only. The size of each oval does not correspond to the number of cases identified by that source.*

Of the 311 cases identified from WDCA, 287 had their injury classified as either a thermal or chemical burn on the claim (Table 2) and for six, the burn cause was not described. The remaining 24 cases had a non-burn injury description or had an unclassified injury in the WDCA database but were included because they were matched to one or more burn reports from other data sources. WDCA cases are displayed in Table 2 by injury cause description.

**Table 2: Injury Causes of Work-Related Burn Cases Identified in Workers' Compensation Claims, Michigan 2018**

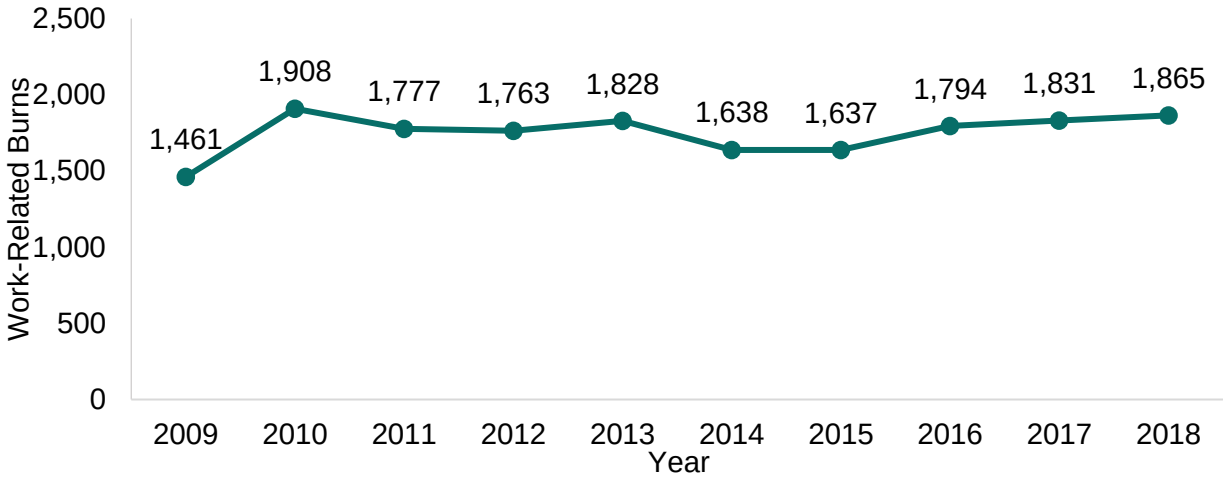
| Injury Cause | Number | Percent |
|---|---|---|
| Burn (Chemical) | 46 | 14.8 |
| Burn (Thermal) | 241 | 77.5 |
| Cut/Laceration | - | - |
| Dislocation | - | - |
| Electric Shock | - | - |
| Fracture | - | - |
| Strain or Sprain | | |
| Unspecified Respiratory Condition | - | - |
| Upper Respiratory Toxic Exposure | - | - |
| Multiple Injuries | - | - |
| Other | - | - |
| Unclassified | 6 | 1.9 |

*Data Source: Michigan Department of Labor and Economic Opportunity Workers' Compensation Agency Database*
*Note: Numbers and corresponding percentages are suppressed when the number of cases is between one and five to protect the confidentiality of individuals.*

## REPORTS BY YEAR

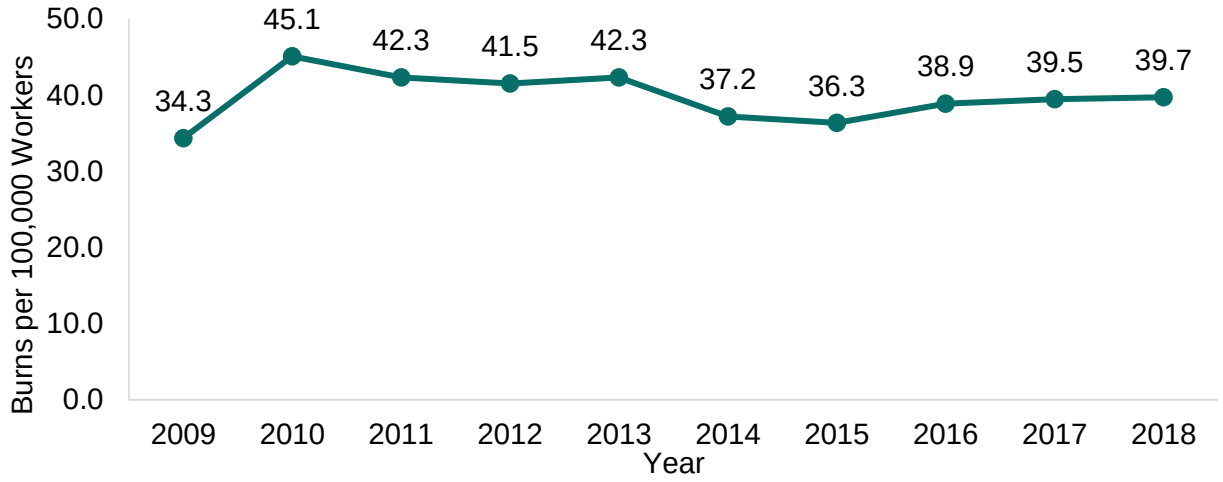
The number of work-related burns in 2018 was higher than the previous eight years (Figure 2). The 1,865 work-related burn incidents among Michigan workers in 2018 represent 1,858 individuals. There were seven individuals who experienced two unique burn injuries during the surveillance period. The average number of work-related burns among Michigan workers from 2009 to 2018 was 1,750.2 (95 percent confidence interval (CI): 1,671.2–1,829.2). The rate of work-related burns increased slightly in 2018 compared to the previous year (Figure 3). The average rate of work-related burns per 100,000 employed individuals from 2009 to 2018 was 39.7 (95 percent CI: 37.8 – 41.6).

**Figure 2: Number of Work-Related Burns, Michigan 2009-2018**




*Data Source: Michigan work-related burns surveillance system*

**Figure 3: Rate (per 100,000) of Work-Related Burns, Michigan 2009-2018**




*Data Sources: Michigan work-related burns surveillance system; Current Population Survey, Bureau of Labor Statistics. Note: Rates presented in Figure 3 may differ from rates provided in previous reports because historical estimates of employed individuals are periodically revised.*

## VISIT TYPE

Type of medical care was determined by review of medical records or PCC consultation records, if available. Among the 1,758 work-related burns with a medical record or PCC consultation, 87.3 percent received care in an emergency department setting (Table 3). Among the 112 cases that were admitted for inpatient care, 86 (76.8 percent) were hospitalized overnight and 26 (23.2 percent) were discharged within the same day. The remaining 112 work-related burns received another type of medical care such as a PCC consultation, clinic visit, or outpatient surgery.

**Table 3: Work-Related Burns by the Type of Medical Encounter, Michigan 2018**

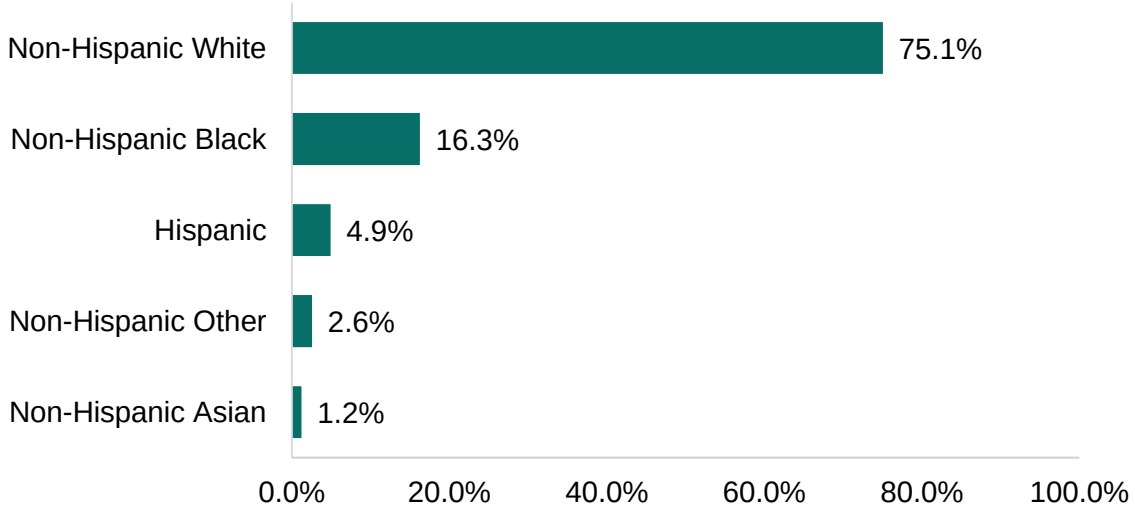
| | Number | Percent |
|---|---|---|
| Emergency Department | 1,534 | 87.3 |
| Inpatient Hospitalization | 112 | 6.4 |
| Other* | 112 | 6.4 |
| **Total** | **1,758** | **100.0** |

*Data Source: Michigan work-related burns surveillance system*
**Other includes PCC consultations, wound clinic visits, outpatient surgery records, occupational health clinic visits, and other unspecified medical care visits.*

## RACE AND ETHNICITY

Race and ethnicity are not recorded on Workers' Compensation claims, therefore race and ethnicity cannot be determined for the 107 cases identified only through Workers' Compensation. Among the 1,758 cases identified through medical records or PCC, 48.9 percent were missing information on race and ethnicity. Only 898 (48.2 percent) of all 1,865 cases had race and ethnicity information documented, therefore data on race and ethnicity should be interpreted with caution because these data may not accurately reflect the total population of work-related burns cases. Non-Hispanic whites accounted for the largest proportion of cases with a known race and ethnicity (Figure 4).

**Figure 4: Percent of Work-Related Burns by Race and Ethnicity, Michigan, 2018**



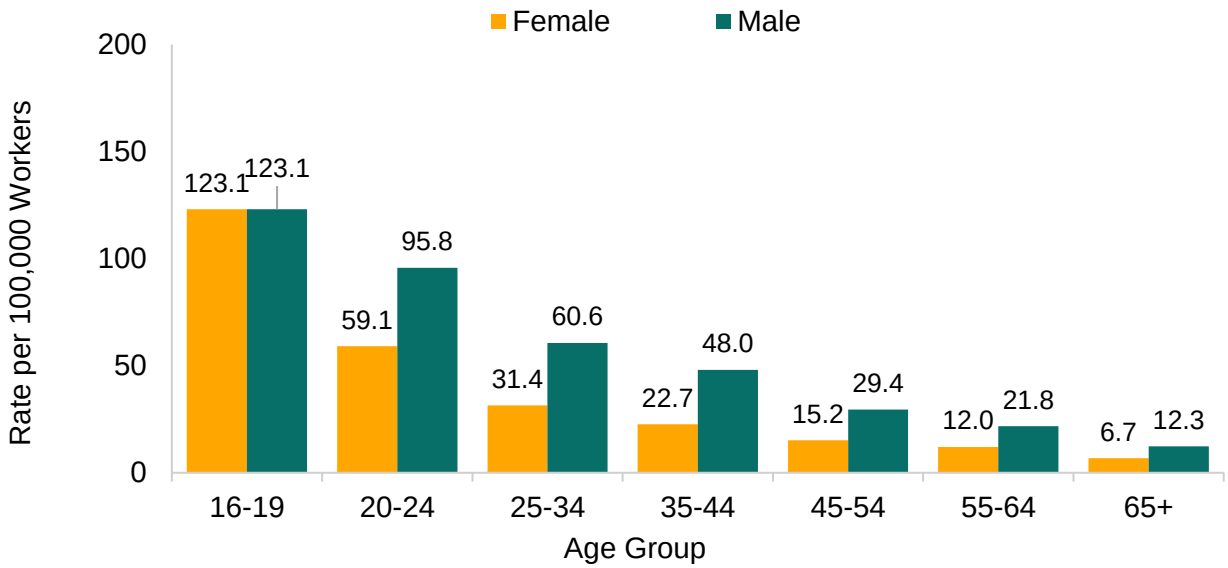

*Data Source: Michigan work-related burns surveillance system*
*Note: This chart excludes 860 cases identified from medical records and PCC with an unknown race and 107 cases identified from Workers Compensation only.*

## AGE AND GENDER

Age was reported for 1,810 (97.1 percent) of work-related burn injuries. The age of workers ranged from 14 to 83 years, with an average of 33.5 years and a median age of 30 years. Almost one-third of work-related burns (31.8 percent) occurred among workers aged 14-24 years. Gender was reported for 1,859 (99.7 percent) of work-related burn injuries. Men accounted for 64.5 percent of work-related burns (n = 1,203) and women accounted for 35.2 percent (n = 656).

Overall, there were 48.5 work-related burns per 100,000 male workers and 29.6 work-related burns among female workers. Among males and females, rates of work-related burns were highest for workers aged 16-19 years (123.1 per 100,000 workers for both sexes). The rate of work-related burns declined with increasing age (Figure 5). Sex was not recorded for six work-related burn cases.

**Figure 5: Rate (per 100,000) of Work-Related Burns by Age Group and Sex, Michigan 2018**




*Data Sources: Michigan work-related burns surveillance system; Current Population Survey, Bureau of Labor Statistics*

*Notes: This chart does not include 58 cases with an unknown age or sex. Rates are not calculated for workers aged 14 to 15 years due to the unavailability of a denominator for this age group and because the number of burns in this age category was fewer than six.*

## PART OF BODY INJURED

Slightly over a third of all work-related burns (33.4 percent) involved burns to the wrists and hands (Table 4). The second most common area affected by work-related burns was the upper limb (17.3 percent). Fewer than 2 percent of work-related burns were unspecified or missing information on the affected area.

**Table 4: Work-Related Burns by Area of Body Injured, Michigan 2018**

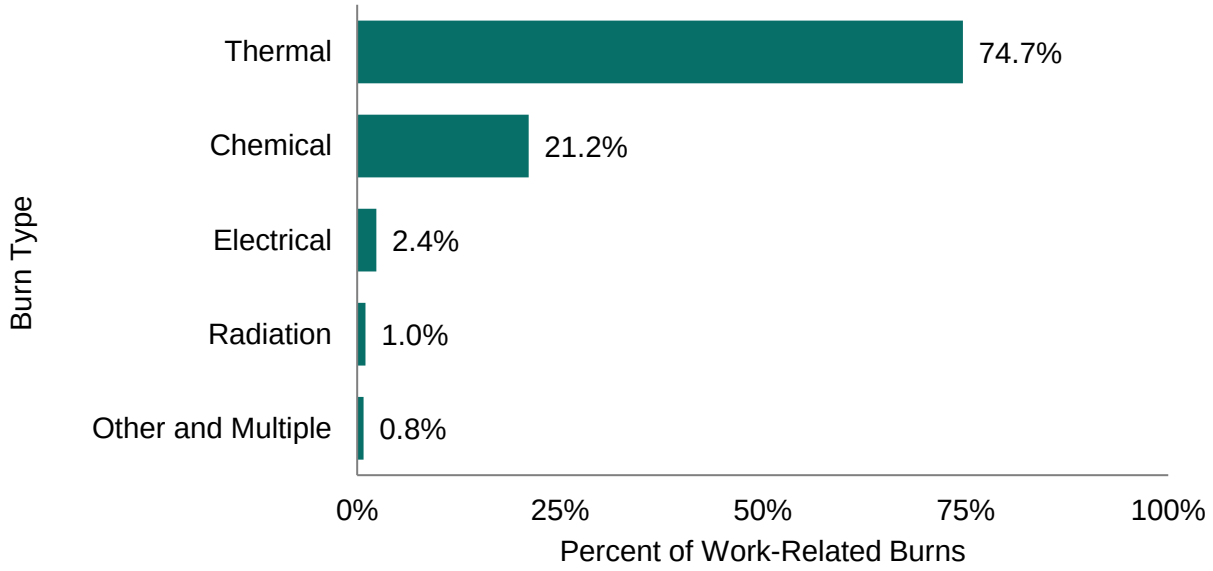
| | Number | Percent |
|---|---|---|
| Eye | 142 | 7.6 |
| Head, Face, Neck | 126 | 6.8 |
| Trunk | 55 | 2.9 |
| Upper Limb | 323 | 17.3 |
| Wrist(s) and Hand(s) | 623 | 33.4 |
| Lower Limb | 267 | 14.3 |
| Multiple Specified Sites | 299 | 16.0 |
| Internal Organs | 8 | 0.4 |
| Classified According to Extent* | 0 | 0.0 |
| Unspecified | 22 | 1.2 |

*Data Source: Michigan work-related burns surveillance system*
**Includes ICD-10-CM codes T31 and T32 and cases where the site of the burn is unspecified, but the percent of body surface burned is documented in the medical record.*

## BURN TYPES

Burn type was documented for 1,659 (89.0 percent) work-related burns. Thermal burns were the most common type with 1,239 (74.7 percent) cases, followed by chemical burns which were reported for 351 (21.2 percent) cases (Figure 6). Commonly reported chemicals involved in chemical burns included lye, sodium hypochlorite (bleach), sulfuric acid, hydrochloric acid, sodium hydroxide, and phosphoric acid. Electrical burns accounted for 39 cases (2.4 percent). Radiation burns, which may result from exposure to ultraviolet rays while welding, were recorded in 17 (1.0 percent) cases. There were 13 cases (0.8 percent) that had other or multiple burn types recorded.

**Figure 6: Work-Related Burns by Type, Michigan 2018**

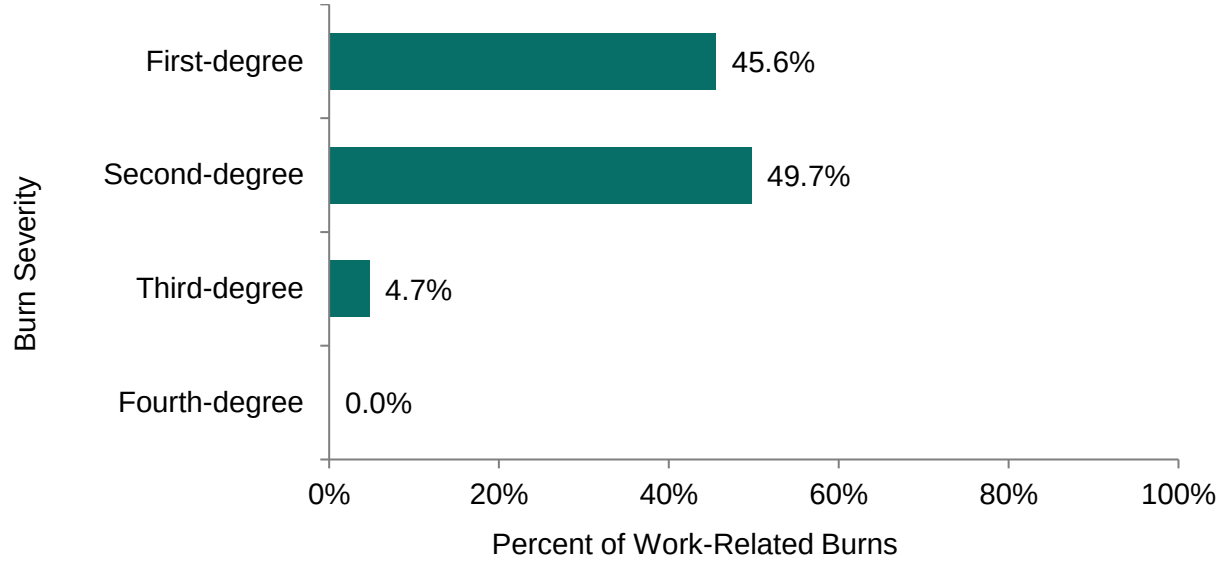



*Data Source: Michigan work-related burns surveillance system*
*Note: This chart excludes 206 cases with an unknown burn type.*

## SEVERITY

Burn degree was specified for 1,758 (94.3 percent) cases. Burns were classified as second-degree in almost half of all cases (49.7 percent). A first-degree, or superficial burn is the least serious and involves only the outermost layer of the skin called the epidermis. A second-degree, or partial thickness burn involves the epidermis and a portion of dermis (the second layer of the skin). A third-degree, or full thickness burn involves the epidermis and dermis and permanently destroys tissue. A fourth-degree burn, the most severe burn, extends through the epidermis, dermis, subcutaneous tissue and into muscle and bone. The skin damaged by a fourth-degree burn is not able to heal itself. Nearly one in-twenty (4.7 percent) work related burns was classified as third-degree. No cases were diagnosed with a fourth-degree burn (Figure 7).

**Figure 7: Work-Related Burns by Maximum Severity*, Michigan 2018**




*Data Source: Michigan work-related burns surveillance system*
*Note: This chart excludes 107 cases with an unknown burn severity.*
**A first-degree, or superficial burn is the least serious and involves only the outermost layer of the skin called the epidermis. A second-degree, or partial thickness burn involves the epidermis and a portion of dermis (the second layer of the skin). A third-degree, or full thickness burn involves the epidermis and dermis and permanently destroys tissue. A fourth-degree burn, the most severe burn, extends through the epidermis, dermis, subcutaneous tissue and into muscle and bone. The skin damaged by a fourth-degree burn is not able to heal itself.*

## COUNTY OF RESIDENCE

Table 5 presents the number and percent of work-related burns by county of residence among the 1,704 Michigan residents where this information was known. There were 132 work-related burn cases among Michigan residents with an unknown county of residence (7.2 percent of work-related burns among Michigan residents). Wayne County had the highest number of residents who sustained a work-related burn with 262 cases (15.4 percent), followed by Oakland County with 107 cases (6.3 percent). These data do not necessarily reflect the county of the worksite because workers may have been employed outside their county of residence.

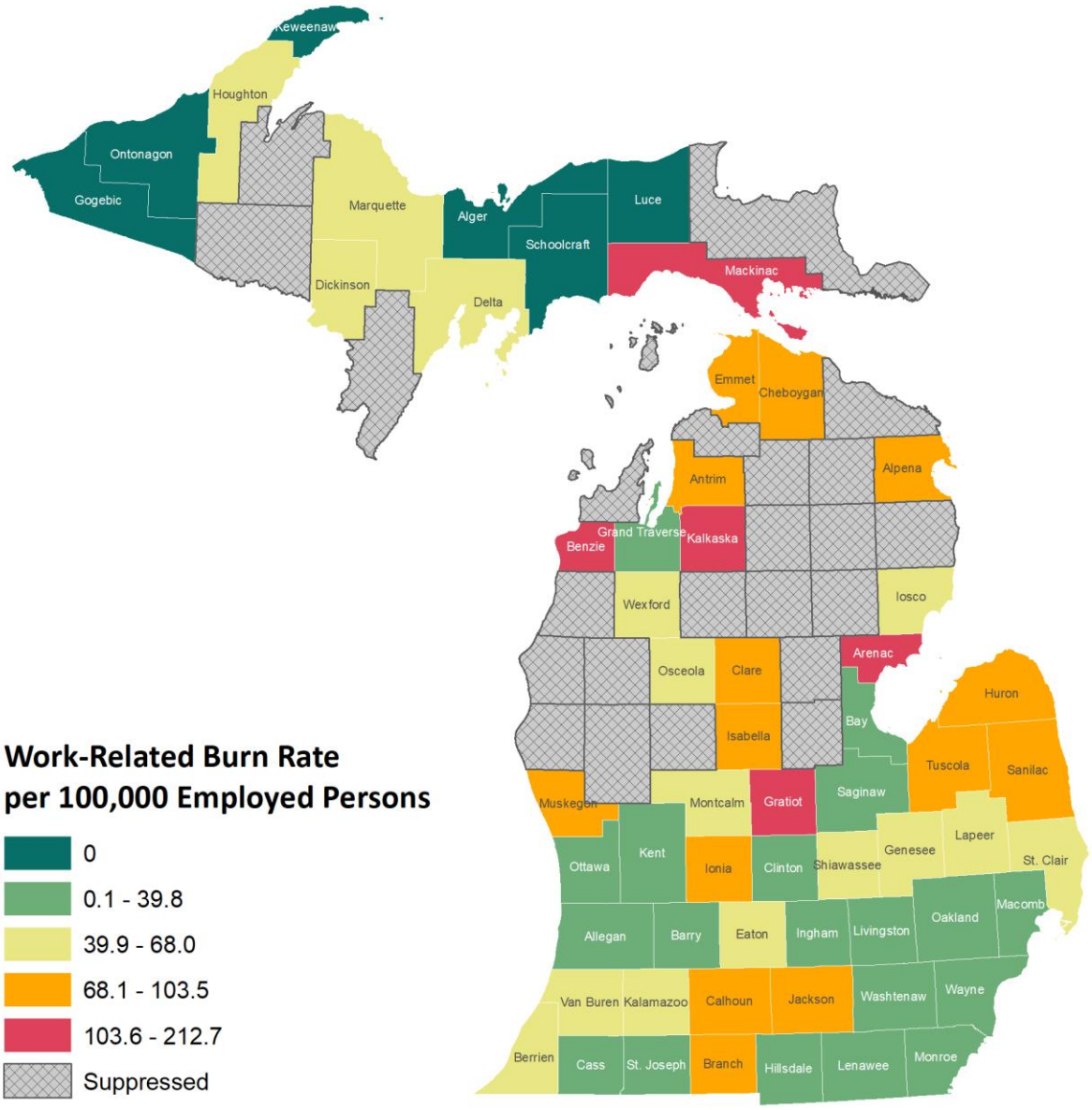
**Table 5: Work-Related Burn Cases and Rate per 100,000 Residents by County of Residence, Michigan 2018**

| County | Number (Rate per 100,000) | County | Number (Rate per 100,000) |
|---|---|---|---|
| Alcona | - | Lake | - |
| Alger | 0 (0) | Lapeer | 17 (43.7) |
| Allegan | 22 (36.7) | Leelanau | - |
| Alpena | 11 (87.0) | Lenawee | 16 (35.6) |
| Antrim | 8 (84.4) | Livingston | 32 (32.1) |
| Arenac | 8 (144.4) | Luce | 0 (0.0) |
| Baraga | - | Mackinac | 10 (212.7) |
| Barry | 8 (26.2) | Macomb | 105 (24.5) |
| Bay | 17 (35.5) | Manistee | - |
| Benzie | 10 (120.6) | Marquette | 21 (68.0) |
| Berrien | 37 (52.8) | Mason | - |
| Branch | 16 (86.0) | Mecosta | - |
| Calhoun | 42 (69.6) | Menominee | - |
| Cass | 7 (29.9) | Midland | - |
| Charlevoix | - | Missaukee | - |
| Cheboygan | 7 (72.1) | Monroe | 18 (24.8) |
| Chippewa | - | Montcalm | 17 (62.7) |
| Clare | 11 (99.3) | Montmorency | - |
| Clinton | 13 (32.7) | Muskegon | 65 (87.4) |
| Crawford | - | Newaygo | - |
| Delta | 8 (49.7) | Oakland | 107 (16.4) |
| Dickinson | 6 (49.8) | Oceana | - |
| Eaton | 28 (50.8) | Ogemaw | - |
| Emmet | 16 (96.2) | Ontonagon | 0 (0.0) |
| Genesee | 76 (43.8) | Osceola | 7 (67.3) |
| Gladwin | - | Oscoda | - |
| Gogebic | 0 (0.0) | Otsego | - |
| Grand Traverse | 14 (29.6) | Ottawa | 45 (28.8) |
| Gratiot | 20 (118.0) | Presque Isle | - |
| Hillsdale | 7 (35.5) | Roscommon | - |
| Houghton | 7 (45.7) | Saginaw | 33 (39.8) |
| Huron | 11 (74.7) | Saint Clair | 32 (44.5) |
| Ingham | 34 (23.4) | Saint Joseph | 7 (25.7) |
| Ionia | 22 (76.2) | Sanilac | 14 (76.9) |
| Iosco | 6 (63.7) | Schoolcraft | 0 (0.0) |
| Iron | - | Shiawassee | 20 (62.9) |
| Isabella | 25 (74.7) | Tuscola | 18 (80.2) |
| Jackson | 74 (103.5) | Van Buren | 20 (60.0) |
| Kalamazoo | 56 (43.4) | Washtenaw | 46 (24.2) |
| Kalkaska | 10 (135.8) | Wayne | 262 (34.6) |
| Kent | 85 (24.4) | Wexford | 8 (57.1) |
| Keweenaw | 0 (0.0) | | |

*Data Source: Michigan work-related burns surveillance system*
*Notes: This table includes only Michigan residents. This table excludes 132 Michigan residents with an unknown county of residence. Data were suppressed when the number of cases was between one and five to protect the confidentiality of individuals.*

Although the number of work-related burns was highest in large, urban counties in Central and Southeast Michigan, the rate of work-related burns per 100,000 employed residents tended to be higher in rural counties in the northern Lower Peninsula and Upper Peninsula (Table 5 and Figure 8). Mackinac County had the highest rate of work-related burns, with 212.7 burns per 100,000 employed residents. Rate calculations excluded residents of other states.

**Figure 8: Rate of Work-Related Burns (per 100,000) by County of Residence, Michigan 2018**




*Data Sources: Michigan work-related burns surveillance system; Local Area Unemployment Statistics, Bureau of Labor Statistics*
*Notes: This map only includes cases among Michigan residents. This map excludes 132 Michigan resident cases with an unknown county. Data were suppressed when the number of cases was between one and five due to statistical unreliability and to protect the confidentiality of individuals. Rates were classified into categories based on natural breaks.*

## INDUSTRY

The industry of the workplace where the work-related burn occurred was determined for 1,482 (79.5 percent) cases. Cases were classified into NAICS industry sector categories, as shown in Table 6. The accommodation and food service industry sector had the highest number (501 cases) and rate of work-related burns at 160.8 cases per 100,000 employed individuals (Table 6). The majority (97.2 percent) of burns in the accommodation and food service industry were within the food services and drinking places subsector.

**Table 6: Number, Percent, and Rate Work-Related Burns by Industry, Michigan 2018**

| NAICS | Description | Number | Percent | Rate per 100,000[†] |
|---|---|---|---|---|
| 11 | Agriculture, Forestry, Fishing and Hunting | 16 | 1.1 | 33.4 |
| 21 | Mining, Quarrying, and Oil and Gas Extraction | 3 | 0.2 | 95.7 |
| 22 | Utilities | 10 | 0.7 | 27.7 |
| 23 | Construction | 93 | 6.3 | 36.9 |
| **31-33** | **Manufacturing (Total)** | 293 | 19.8 | 32.5 |
| 31 | *Food, Beverage, Textile Manufacturing* | 46 | 3.1 | 72.9 |
| 32 | *Wood Products, Paper, Petroleum and Coal Products Manufacturing* | 69 | 4.7 | 48.5 |
| 33 | *Primary Metal Manufacturing* | 178 | 12.0 | 25.5 |
| 42 | Wholesale Trade | 36 | 2.4 | 39.5 |
| 44-45 | Retail Trade | 89 | 6.0 | 18.9 |
| 48-49 | Transportation and Warehousing | 21 | 1.4 | 12.3 |
| 51 | Information | 5 | 0.3 | 7.1 |
| 52 | Finance and Insurance | 10 | 0.7 | 5.4 |
| 53 | Real Estate and Rental and Leasing | 13 | 0.9 | 18.4 |
| 54 | Professional, Scientific, and Technical Services | 26 | 1.8 | 8.6 |
| 55 | Management of Companies and Enterprises | 0 | 0.0 | 0.0 |
| 56 | Administrative and Support and Waste Management and Remediation Services | 57 | 3.8 | 30.2 |
| 61 | Educational Services | 33 | 2.2 | 7.6 |
| 62 | Health Care and Social Assistance | 124 | 8.4 | 18.1 |
| 71 | Arts, Entertainment, and Recreation | 36 | 2.4 | 40.3 |
| 72 | Accommodation and Food Services | 501 | 33.8 | 160.8 |
| 81 | Other Services (except Public Administration) | 61 | 4.1 | 27.2 |
| 92 | Public Administration | 55 | 3.7 | 35.0 |

*Data Sources: Michigan work-related burns surveillance system; Current Population Survey, Bureau of Labor Statistics*

*Notes: This table excludes 383 cases with an unknown industry. Data were suppressed when the number of cases was between one and five due to statistical unreliability and to protect the confidentiality of individuals.*

## SEVERITY OF BURNS BY INDUSTRY

The primary metal manufacturing industry had the highest percentage of burns classified as a third-degree burn (12.4 percent). The educational services industry had the highest percentage of work-related burns classified as first-degree (69.7 percent), which are the least severe burns. Although the public administration industry had the highest percentage of second-degree burns (61.8 percent), the accommodation and food services industry had the highest number of second-degree burns (288) (Table 7).

**Table 7: Number and Percent of Work-Related Burns by Severity* within Industry Groups, Michigan 2018**

| | 1st Degree | 2nd Degree | 3rd Degree | 4th Degree | Unspecified |
|---|---|---|---|---|---|
| Agriculture, Forestry, Fishing and Hunting | 9 (56.3%) | - | - | 0 (0.0%) | - |
| Mining, Quarrying, and Oil and Gas Extraction | 0 (0.0%) | - | 0 (0.0%) | 0 (0.0%) | - |
| Utilities | 6 (60.0%) | - | - | 0 (0.0%) | 0 (0.0%) |
| Construction | 40 (43.0%) | 33 (35.5%) | 10 (10.8%) | 0 (0.0%) | 10 (10.8%) |
| **Manufacturing (Total)** | **105 (35.8%)** | **134 (45.7%)** | **33 (11.3%)** | **0 (0.0%)** | **21 (7.2%)** |
| *Food, Beverage, Textile Manufacturing* | 16 (34.8%) | 24 (52.2%) | - | 0 (0.0%) | - |
| *Wood, Paper, Petroleum and Coal Products Manufacturing* | 22 (31.9%) | 33 (47.8%) | - | 0 (0.0%) | - |
| *Primary Metal Manufacturing* | 67 (37.6%) | 77 (43.3%) | 22 (12.4%) | 0 (0.0%) | 12 (6.7%) |
| Wholesale Trade | 15 (41.7%) | 16 (44.4%) | - | 0 (0.0%) | - |
| Retail Trade | 49 (55.1%) | 36 (40.4%) | - | 0 (0.0%) | - |
| Transportation and Warehousing | 9 (42.9%) | 10 (47.6%) | - | 0 (0.0%) | - |
| Information | - | - | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| Finance and Insurance | - | - | - | 0 (0.0%) | - |
| Real Estate and Rental and Leasing | 7 (53.8%) | - | - | 0 (0.0%) | - |
| Professional, Scientific, and Technical Services | 9 (34.6%) | 15 (57.7%) | - | 0 (0.0%) | - |
| Management of Companies and Enterprises | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| Admin, Support, Waste Management and Remediation Services | 26 (45.6%) | 30 (52.6%) | - | 0 (0.0%) | - |
| Educational Services | 23 (69.7%) | 10 (30.3%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| Health Care and Social Assistance | 79 (63.7%) | 37 (29.8%) | - | 0 (0.0%) | - |
| Arts, Entertainment, and Recreation | 14 (38.9%) | 20 (55.6%) | - | 0 (0.0%) | - |
| Accommodation and Food Services | 184 (36.7%) | 288 (57.5%) | 6 (1.2%) | 0 (0.0%) | 23 (4.6%) |
| Other Services (except Public Administration) | 33 (54.1%) | 25 (41.0%) | - | 0 (0.0%) | - |
| Public Administration | 19 (34.5%) | 34 (61.8%) | - | 0 (0.0%) | - |
| **Total** | 629 (42.4%) | 707 (47.7%) | 70 (4.7%) | 0 (0.0%) | 76 (5.1%) |

*Data Sources: Michigan work-related burns surveillance system*

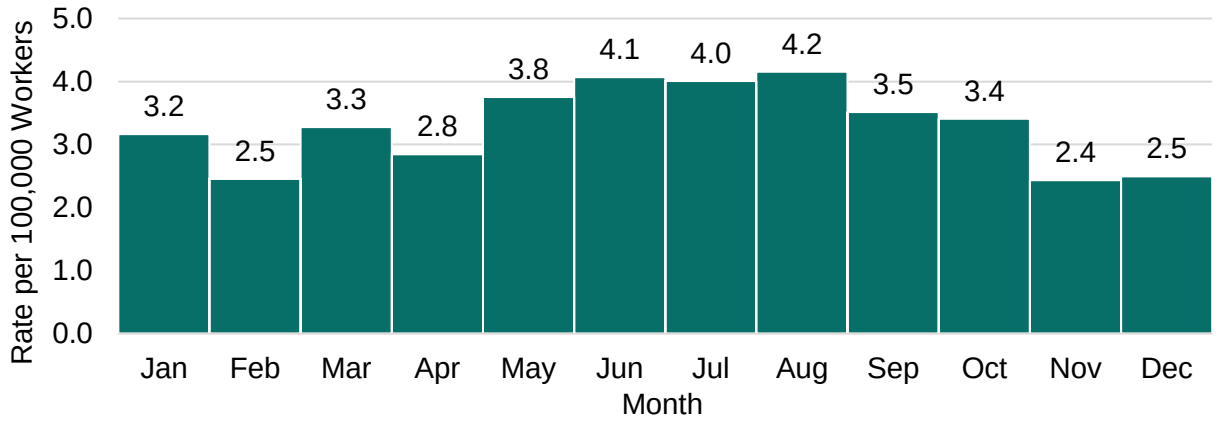
**A first-degree, or superficial burn, is the least serious and involves only the outermost layer of the skin called the epidermis. A second-degree, or partial thickness burn, involves the epidermis and a portion of dermis (the second layer of the skin). A third-degree, or full thickness burn, involves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

*Notes: This table excludes 383 cases with an unknown industry. Data were suppressed when the number of cases was between one and five due to statistical unreliability and to protect the confidentiality of individuals.*

## MONTH OF INJURY

The month of injury was documented for all 1,865 cases. The rate of work-related burns was highest during the summer months of June, July, and August, at 4.1, 4.0, and 4.2 work-related burns per 100,000 workers, respectively (Figure 9). The lowest rate occurred in November, with 2.4 burns per 100,000 workers. Seasonally adjusted estimates of employed individuals were used as the denominator for rate calculation to account for fluctuations in the workforce due to seasonal hiring patterns.

**Figure 9: Rate (per 100,000) of Work-Related Burns by Month of Injury, Michigan 2018**




*Data Sources: Michigan work-related burns surveillance system; Bureau of Labor Statistics' Local Area Unemployment Statistics seasonally adjusted employment estimates.*

## SOURCE OF PAYMENT

Workers' Compensation was the expected payer for medical care in 56.9 percent of the 1,758 cases with a medical record (Table 8). Among cases with an expected payer of Workers' Compensation, 147 also received wage replacement for more than seven days away from work. There were 31 work-related burns that did not list Workers' Compensation as a payment source for medical care but were matched to a record in the WCDA database. Payment source was not documented for 263 work-related burns with a medical record.

**Table 8: Work-Related Burns by Expected Source of Payment for Medical Services and Receipt of Workers' Compensation Wage Replacement**

| Payer | Received Wage Replacement* | No Wage Replacement | Total | Percent of Cases |
|---|---|---|---|---|
| Workers' Compensation | 147 | 853 | 1,000 | 56.9 |
| Commercial | 3 | 194 | 197 | 11.2 |
| Self-Pay | 6 | 66 | 72 | 4.1 |
| Medicaid or Medicare | 5 | 201 | 206 | 11.7 |
| Other | 0 | 20 | 20 | 1.1 |
| Unknown | 15 | 248 | 263 | 15.0 |

*Data Source: Michigan work-related burns surveillance system*

**Includes claims that are currently being paid and claims that have not been paid yet but are expected to be paid.*

## MIOSHA REVIEWS

MIOSHA reviewed work-related burn cases reported to MSU OEM if the worker had been hospitalized or treated in an ED or outpatient facility, sustained at least a second-degree burn, and the injury had occurred within six months of the report. MIOSHA conducted inspections at 15 worksites. Of the 15 inspected worksites, 13 (86.7 percent) were cited for one or more MIOSHA safety violations. MIOSHA issued a total of 21 violations and $43,850 in penalties to employers based on work-related burns reported by MSU OEM (Table 9). None of the 15 worksites had abated the hazard that caused the burn at the time of the inspection, which was conducted three to six months after the burn occurred.

**Table 9: Number of MIOSHA Workplace Inspections, Issued Violations and Amount of Penalties Assessed by Industry, Michigan 2018**

| | Inspections | Violations | Penalties |
|---|---|---|---|
| Construction | 1 | 1 | $900 |
| **Manufacturing (Total)** | **13** | **17** | **$41,650** |
| *Food, Beverage, Textile Manufacturing* | *2* | *2* | *$8,800* |
| *Wood Products, Paper, Petroleum, Coal Products Manufacturing* | *2* | *3* | *$7,800* |
| *Primary Metal Manufacturing* | *9* | *12* | *$25,050* |
| Other Services, except public administration | 1 | 3 | $1,300 |
| **Total** | **15** | **21** | **$43,850** |

*Data Source: Michigan work-related burns surveillance system*

## TWO EXAMPLES OF MIOSHA ENFORCEMENT INSPECTIONS FOR A WORK-RELATED BURN

### Improper Energy Control Procedure

An employee of a food manufacturing company that produced refined sugar received third degree thermal burns to his trunk and second degree burns to his foot and ankle while working with a machine that heated sucrose. The employee was performing maintenance on the machine, which had not been properly disconnected from the power source. The machine was engaged unintentionally, releasing molten sucrose on the employee. The employee was treated in the emergency department for his burn injuries. Upon inspection of the worksite, MIOSHA found one serious violation. The following citation was issued to the employer; Citation 1: procedures shall be developed, documented, and utilized for the control of potentially hazardous energy when employees are engaged in the activities covered by this section (energy control procedure), (1910.147(c)(4)).

### Hazardous Conditions

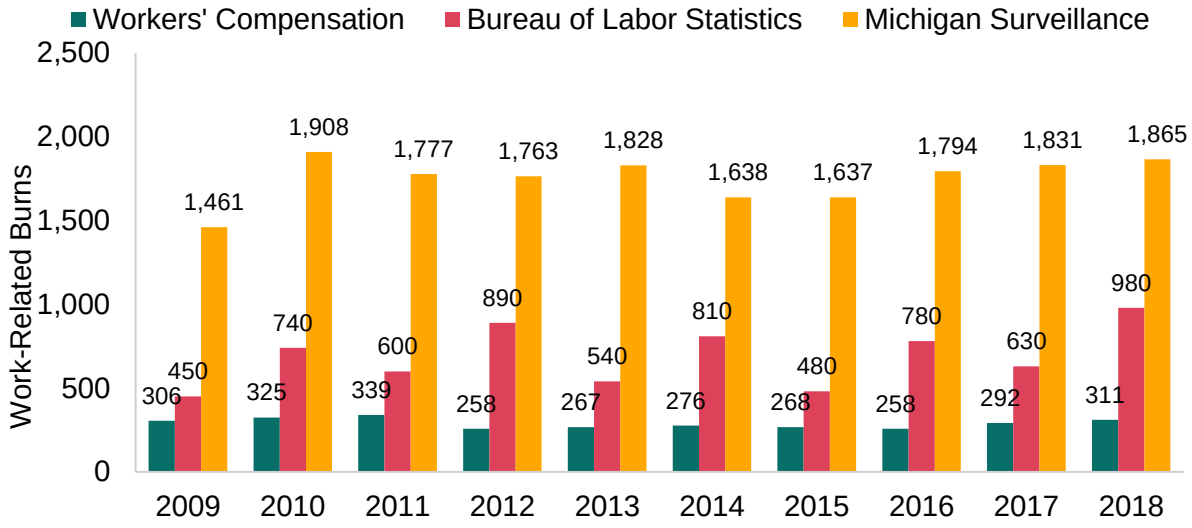
An employee of a motor vehicle metal stamping manufacturer was improperly standing on top of a machine containing heated solvent. The machine cover became dislodged, causing the employee's foot to slip into the heated solvent. The employee sustained second degree thermal and chemical burns to his foot. MIOSHA issued a citation for a serious workplace safety violation. The following citation was issued to the employer; Citation 1: the employer must ensure hazardous conditions on walking-working surfaces are corrected or repaired before an

employee uses the walking-working surface again. If the correction or repair cannot be made immediately, the hazard must be guarded to prevent employees from using the walking-working surface until the hazard is corrected or repaired (1910.022(d)(22).

### COMPARISON OF SURVEILLANCE SYSTEMS

The Michigan-based surveillance system has consistently detected a greater number of work-related burns than either the Workers' Compensation database or the BLS SOII over the past ten years (Figure 10). The annual number of work-related burns detected by the Michigan-based surveillance system has been on average 167 percent higher than the official BLS SOII estimates and 508 percent higher than the estimate identified from Workers' Compensation claims from 2009 through 2018. In 2018, the Michigan-based surveillance system identified 885 more work-related burns than the BLS SOII and 1,554 more work-related burns than Workers Compensation.

**Figure 10: Number of Work-Related Burns by Surveillance Source, Michigan 2009-2018**




*Data Sources: Michigan work-related burns surveillance system, Michigan Department of Labor and Economic Opportunity Workers' Disability Compensation Agency Database, Bureau of Labor Statistics Survey of Occupational Injuries and Illnesses*

## DISCUSSION

The overall rate of work-related burns during 2018 was 39.7 burns per 100,000 workers. The rate has remained relatively consistent over the past nine years, ranging from 34.3/100,000 to 45.1/100,000. Workers under 20 years of age experienced the highest rate of work-related burns. Males also experienced a higher rate of work-related burns compared to females. The accommodation and food service industry accounted for the highest number and rate of work-related burns with 501 cases and a rate of 160.8 work-related burns per 100,000 workers. Among these cases, 97.7 percent were in the food services and drinking places subsector, which includes full- and limited-service restaurants, caterers, bars, and other similar establishments. Most (74.7 percent) work-related burns were caused by a thermal exposure and about half were classified as a second-degree burn (49.7 percent). It is possible that the distribution of work-related burn severity is biased to more severe burns because first-degree

burns are less likely to require medical treatment and less likely to result in missed days of work and thus less likely to generate a Workers' Compensation claim.

The Michigan work-related burn surveillance system has consistently detected a greater number of work-related burns than both the BLS SOII and the WCDA database from 2009 to 2018. The BLS's undercount of work-related burns is partially explained by the fact that BLS only knows the type of injury for cases with one or more days away from work or with altered work duties, whereas the Michigan multi-source surveillance system counted work-related burns regardless of how many days of work were missed or if the burn resulted in altered work duties. Secondly, the BLS excludes self-employed, household employees, and farm workers who work on farms with less than 11 employees. Michigan's burn surveillance identified only 46 self-employed individuals and 16 farm workers in 2018 with a work-related burn so the difference in the type of workers covered in each system would not be an important factor to explain the undercount in the BLS data. Other possible explanations for the BLS undercount may be that employers are not providing complete case reports, the statistical sampling procedure of BLS, or employers are not properly identifying employee injuries as burns. A factor that will cause small differences in the rates between the Michigan multi-source system and BLS is that the denominator used in the Michigan multi-source system is the number of workers and BLS uses full time equivalents.

The Workers' Compensation database identified only 311 (16.7 percent) of the work-related burns. There are a number of possible explanations for the Workers' Compensation difference. 1) The WDCA data set only included burns that caused more than seven consecutive days away from work, presumably the most severe cases. 2) WDCA excluded the self-employed, but again there were only 46 self-employed workers in 2018 in Michigan' multi-source reporting system. 3) There were coding errors in the WDCA data. Matching WDCA claims with hospital records identified 24 work-related burns that were not classified as burns in the WDCA data. Potentially there were other injuries in the WDCA database that were similarly misclassified but were not identified because no medical records were received. 4) Some companies may be handling burns unofficially and not reporting them to Workers' Compensation insurance companies or the WDCA.

MIOSHA declared a strategic goal for fiscal years 2014 to 2018 to reduce the rate of worker injuries and illnesses in high-hazard industries by 15 percent (Goal 1.1) and updated it for the 2019-2023 plan to reduce the annual incidence rate in high hazard industries by 2 percent per year.[6] The Michigan-based surveillance of work-related burns is critical to supporting the achievement of this goal because it provides a reliable mechanism for measuring progress and identifying important risk factors and helps facilitate MIOSHA reviews and inspections of potentially hazardous workplaces. Improvements to the timeliness of surveillance data, such as requiring hospitals to report cases on a quarterly basis rather than annually, have allowed MIOSHA to perform more inspections within the six-month window. Additionally, the Michigan-based surveillance system can quickly adapt to emerging issues and concerns at the state level; for example, Michigan lowered the age of cases required to be reported from 16 to 14 years in 2011 to capture burn injuries among working teens. Data are also used to develop and target educational materials for employers and employees in high-risk industries and professions.

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