Work-Related Crushing Injuries in Michigan: Second Report (January 2016 – December 2018)

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Work-Related Crushing Injuries in Michigan:

Second Report

(January 2016 – December 2018)

A Joint Report of

Michigan State University

and

Michigan Department of Labor and Economic Opportunity

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EXECUTIVE SUMMARY

Michigan State University's Occupational and Environmental Medicine Division compiles data on work-related crushing injuries in the state of Michigan. This is the second report on occupational crushing injuries in Michigan; it covers three years, 2016, 2017 and 2018. These are the key findings:

- Work-related crushing injuries were identified through multiple reporting sources
  - In 2016, there were 1,066 work-related crushing injuries, including four deaths in1,066 individuals.
  - In 2017, there were 1,079 work-related crushing injuries, including seven deaths in 1,076 individuals.
  - In 2018, there were 1,274 work-related crushing injuries, including five deaths, in 1,272 individuals.
  - Over the three years combined, there were 3,419 work-related crushing injuries in 3,414 individuals; 2 individuals each sustained 2 unique crushing injuries in the same calendar year and 3 individuals had 2 unique crushing injuries in two different calendar years.
- For 2016 through 2018, the Federal tracking system that relies on employer reporting, estimated only 1,030 work-related crushing injuries in Michigan or 30.1% of the total of 3,419 crushing injuries we identified in the three years (48.8% of our Michigan multi-source total in 2016, 20.4% of our total for 2017 and 22.8% of our total for 2018). The U.S. Bureau of Labor Statistics' estimated rate was 16 per 100,000 full-time equivalent (FTE) workers in 2016, 6 per 100,000 FTEs in 2017 and 9 per 100,000 FTEs in 2018, which was only 69.6%, 26.1% and 33.3% of the rate of 23, 23 and 27 per 100,000 workers of work-related crushing injuries identified in Michigan's multi-source reporting system.
- The most common type of medical encounter was an emergency room visit (2,556; 75.0%).
- Eighty percent of all work-related crushing injuries were among men and 81.6% were among Caucasians.
- The most common part of the body injured was an upper limb (2,387; 69.8%) followed by a lower limb (758; 22.2%).
- Two NORA Sector Groups – Manufacturing and Services (except Public Safety) accounted for over a half (57.2%) of all work-related crushing injuries.
- Mining (except Oil and Gas Extraction) Sector Group had the highest rate of crushing injuries with 147.4/100,000 workers, followed by Oil and Gas Extraction Sector Group with 123.5/100,000 workers.

- “Pinched between” and “Struck by falling object” were the two main causes of work-related crushing injuries with 37.0% and 21.4%, respectively.
- Workers’ Compensation was the expected payer for only 71.1% of the 3,071 crushing injuries that were identified in the hospital/ED records and for which the payer type was specified.
- For 2016 through 2018, the Michigan OSHA program completed inspections at 50 worksites identified by the surveillance system as having had a crushing injury. MIOSHA issued 97 violations and assessed $287,250 in fines. In 42 of these 50 inspections the employer had not addressed the circumstances causing the crushing injury (e.g., no guard on the machine where the crushing injury occurred) even though the MIOSHA inspection was performed months after the occurrence of the injury.

BACKGROUND

This is the second report on occupational crushing injuries in Michigan. The report is based on data for 2016 through 2018. A crushing injury occurs when force or pressure is put on a body part.[1] This type of injury most often happens when part of the body is caught between, squeezed or put under pressure between heavy objects.

Occupational crushing injuries are among the most severe injuries that occur in the workplace. Like all workplace injuries they are potentially preventable. Michigan Department of Health and Human Services' (MDHHS) regulations define traumatic injury as a "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. Mechanical energy injuries include acceleration and deceleration injuries, blunt trauma, and penetrating wound injuries".[2] Health professionals and health facilities are required to report individuals with all injuries, including crushing injuries, regardless of cause, when requested by the Michigan Department of Health and Human Services. The Michigan work-related crushing injuries surveillance system, based on mandatory reporting, is used to identify causes of work-related crushing injuries, target interventions to reduce crushing injuries and evaluate the effectiveness of these interventions.

The U.S. Bureau of Labor Statistics (BLS), the official source of work-related injury statistics, estimated 13,410 work-related crushing injuries in 2016 nationwide (incidence rate of 12 workers per 100,000 full-time workers), 12,330 in 2017 (incidence rate of 11 workers per 100,000 full-time workers), and 11,810 in 2018 (incidence rate of 10 workers per 100,000 full-time workers).[3,4,5] The BLS estimates are based on employer reporting through the Survey of Occupational Injuries and Illnesses (SOII). The BLS estimate includes private industry and state and local government workers but not the self-employed or farms with fewer than 11 employees. BLS reported 520 non-fatal work-related crushing injuries for Michigan in 2016 (incidence rate of 16 workers per 100,000 full-time workers), 220 in 2017 (incidence rate of 6 workers per 100,000 full-time workers), and 290 in 2018 (incidence rate of 9 workers per 100,000 full-time workers).

Michigan State University's College of Human Medicine, Occupational and Environmental Medicine Division operates the crushing injuries surveillance system as the bona fide agent for the State. Once a work-related diagnosis is confirmed and a case meets designated criteria, MIOSHA makes a determination whether or not to conduct a workplace investigation.

DATA SOURCES AND METHODS

There were three reporting sources of work-related crushing injuries:

- Hospitals/Emergency Departments/Hospital Outpatients
- Workers' Disability Compensation Agency (WDCA)
- Michigan Fatality Assessment and Control Evaluation (MIFACE)[6]

All 134 of Michigan's acute care hospitals, including Veterans' Administration Hospitals, were required to report work-related crushing injuries. Discharge summaries and ED notes were reviewed to differentiate the work and non-work-related crushing injuries treated at a hospital/emergency department (ED) or as an outpatient visit at a hospital-based clinic. Cases to be reported were defined as any individual aged 16 years or older receiving medical treatment at a Michigan hospital/ED/hospital outpatient for whom:

(a) A crushing injury-related ICD-10 diagnosis code[7] was assigned as either the primary or any secondary diagnosis (Table 1), and
(b) The incident was recorded as having occurred at work.

Table 1. Work-Related Crushing Injury ICD-10 Diagnosis Codes

Crushing Injury ICD-10 Codes	
S07	Head
S17	Neck
S28	Thorax, and Traumatic Amputation of Part of Thorax
S38	Abdomen, Lower Back, Pelvis and External Genitals, Including Amputation
S47	Shoulder and Upper Arm
S57	Elbow and Forearm
S67	Wrist, Hand and Fingers
S77	Hip and Thigh
S87	Lower Leg
S97	Ankle and Foot

The Michigan WDCA provided access to a database of paid 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 a "Crush/Contusion" (WDCA's Condition Type Code 160) to any part of the body. Crushing injuries in the WDCA cannot be distinguished from the much more common contusion injuries as both types of injuries are coded in the worker compensation database with the single code 160.

Cases identified through the MIFACE program were identified as individuals whose underlying cause of death was from a crushing injury.

Information from the hospital/ED medical reports and MIFACE reports on each case were abstracted, including: type of medical care (hospital overnight, ED, outpatient), hospital name, date of admission and discharge, patient demographics, city and county of residence, source of payment, information on whether the worker was self-employed, employer information (name, address, NAICS code), injury date, ICD code, cause of injury, side injured, digit injured, information on whether a power press injury. Once these crushing injury data were entered into a Microsoft Access database, records were manually linked to records in the Workers' Compensation database. Matches were identified using an individual's first and last name, date of birth and date of injury.

Information from Workers' Compensation on matched cases was added to the database. Duplicates identified by more than one reporting source were only counted once, abstracting all information from every data source. NAICS codes were converted to NORA Sector Group.

Individuals whose workplaces could not be identified in the records and met the criteria for a possible MIOSHA inspection were contacted by telephone to obtain employer information. The criteria for a possible to MIOSHA inspection were: 1) the individual had to be hospitalized, treated in an emergency department or as an outpatient at a hospital in 2016, 2017 or 2018, 2) the injury did not occur to a self-employed individual or an individual employed by an employer not covered by Michigan OSHA (e.g., federal, railroad, merchant marine, dock or mine employee), 3) the circumstances of the injury suggested there was an ongoing hazard and 4) the crushing injury occurred in the last six months.

For cases inspected by MIOSHA, additional information was obtained about the results of the inspection: inspection date, whether the hazard causing the crushing injury was present at the time of the inspection, number of violations, and total fines assessed.

Data analysis was performed using queries conducted in Microsoft Access. The NIOSH Employment Labor Force Query System, which uses BLS Current Population Survey (CPS) data, provides the estimated number of employed Michigan residents by age group, gender and industry for 2016 through 2018.[9]

The BLS Occupational Injuries and Illnesses and Fatal Injuries Profiles online tool was used to generate the 2016, 2017 and 2018 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.[10-15] Three codes were used to generate the estimates and incidence rates: 1971XX (Crushing Injuries) – the code includes crushing injuries to upper and lower extremities – arm, hand, leg; 194XXX (Internal injuries to organs and blood vessels of the trunk) – the code includes crushing injuries involving internal organs; and 160XXX (Intracranial injuries, unspecified) – the code includes crushing injuries to the head.

RESULTS

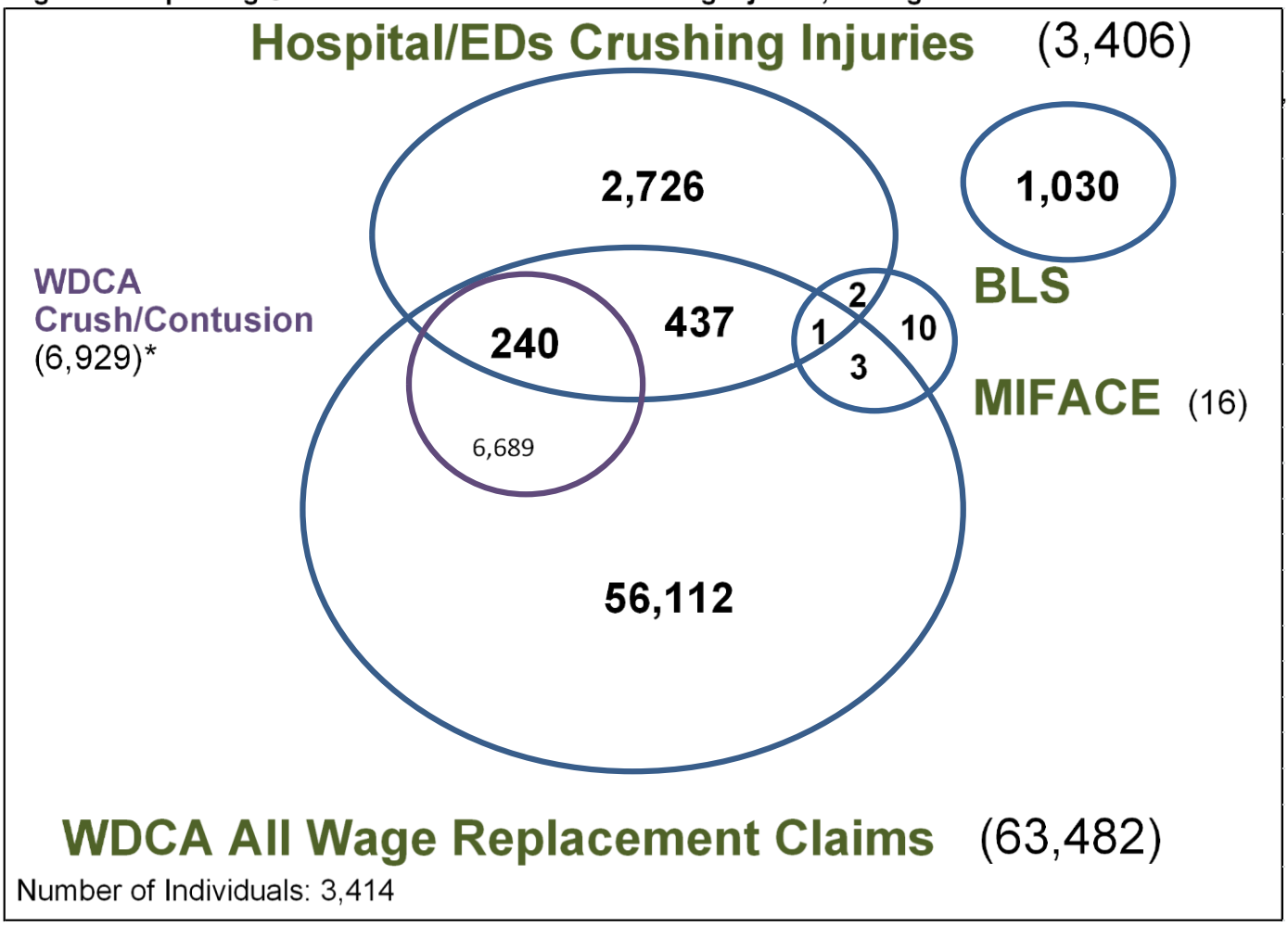
In 2016, 1,066 individuals, in 2017, 1,076 individuals, and in 2018, 1,272 individuals sustained a work-related crushing injury.

2016-2018 Combined: There were 3,419 work-related crushing injuries in 3,414 individuals because two individuals each sustained two unique crushing injuries in the same calendar year and three individuals had two unique crushing injuries in two different calendar years.

Reporting Sources

The number of 2016-2018 work-related crushing injuries in Michigan by the reporting source and a comparison with the number estimated by BLS is shown in Figure 1.

Figure 1. Reporting Sources of Work-Related Crushing Injuries, Michigan 2016 - 2018



*The same code 160 is used for both crushing injuries and contusions so the two cannot be differentiated in the Workers' Compensation database.

Hospitals/ED reports identified 3,406 cases and MIFACE program identified 16 cases. Hospital/ED reports matched with 677 WDCA reports of crushing and contusion injuries. Two hospital/ED reports matched with two MIFACE reports. Three MIFACE reports matched with three WDCA reports. Ten crushing injury cases were identified by the MIFACE program only. One case was identified by all three reporting sources. Because of confidentiality restrictions, no attempt was made to match the Michigan data set with the BLS data set.

There were 677 injuries in the WDCA database that matched with work-related crushing injuries identified in the medical record, one injury in the WDAC database that matched with a work-related crushing injury identified in a medical record and one crushing injury

fatality identified thru the MIFACE program, and three WDCA injuries that matched with three crushing injury fatalities identified through the MIFACE program. Two hundred and forty hospital/ED reports were matched with the WDCA Crush/Contusion records. The other 438 were included because they matched with names from one or more of the other data sources, although they had an injury description in the WDCA as something other than “Crush/Contusion” injury. The descriptions in WDCA for these 438 were: 175 “Fracture”, 110 “Cut/Laceration”, 47 “Strains/Sprains”, 36 “Multiple Injuries”, 31 “Unclassified”, 6 “Amputation”, 9 “Other Injuries/Nec, 8 “Burn (Heat)”, 3 “Infl-Joints”, 2 “Abrasion/Scratch”, 2 “Concussion”, 1 “Carpal Tunnel”, 1 “Dislocation”, ”, and 1 “Hernia”. Matches were made based on the employee’s first and last name, date of birth, date of injury, employee’s zip code and employer information.

There were another 6,689 crush/contusion injuries identified in the WDCA database.

An emergency room visit was the most common type of medical encounter, 2,556 (75.0%) cases (Table 2).

Table 2. Work-Related Crushing Injuries by the Type of Medical Encounter, Michigan 2016-2018*

Medical Encounter Type	Number	Percent
Hospitalization	318	9.4
Emergency Department	2,556	75.0
Outpatient	532	15.6
Total	3,406	100.0

*Information on the type of medical encounter was provided for 3,406 (99.6%) individuals.

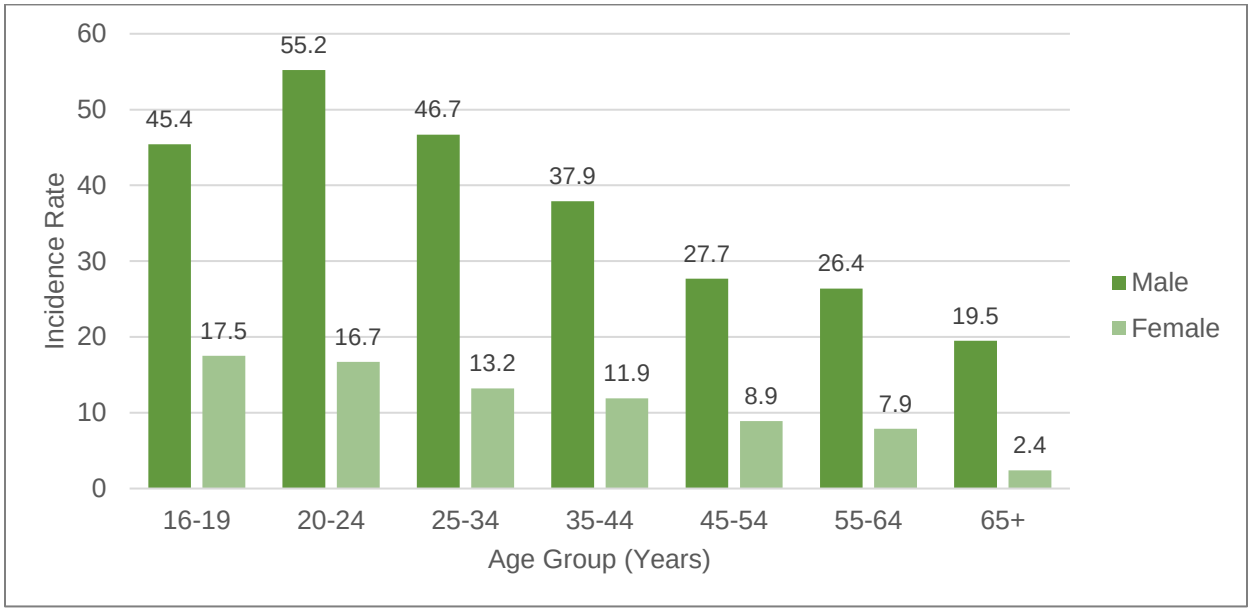
Characteristics of Injured Workers

Age and Gender

Gender was not available for two workers. The age of injured workers varied from 16 to 89 years. The average age was 37.8 and the median age was 36.0. Two thousand five hundred and thirteen (80.3%) of all work-related crushing injuries were among men.

Figure 2 displays crushing injury rates by age group and gender. Among males, rates were highest for workers in the 20-24 and 25-34 age groups, 55.2/100,000 and 46.7/100,000, respectively. For females, the age groups with the highest rate of crushing injury were 16-19 and 20-24 with 17.5/100,000 and 16.7/100,000, respectively.

Figure 2. Work-Related Crushing Injury Rates by Age Group and Gender, Michigan 2016-2018*



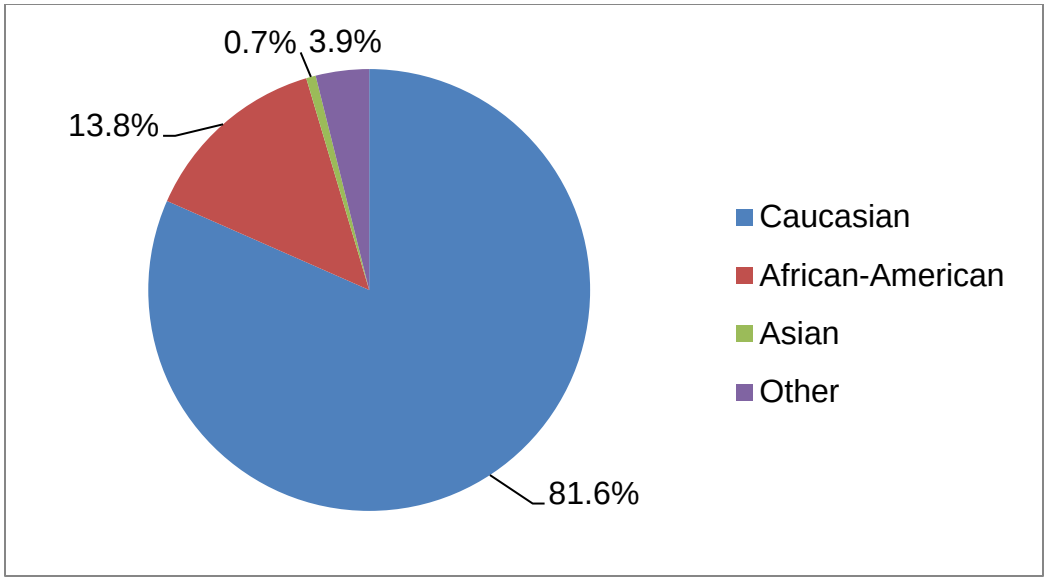
*Data Sources: Number of work-related skull fractures – Michigan hospital/ED medical records and WDCA; Total number of workers – NIOSH Employment Labor Force Query System.
Rates are the number of workers sustaining a crushing injury per 100,000 workers (number of workers employed by age group used to calculate rates: Bureau of Labor Statistics' Current Population Survey).[9]

Race and Ethnicity

The race of workers with work-related crushing injuries is shown in Figure 3. Among the workers for whom the race was available (1,761, 51.6%), 1,437 (81.6%) were Caucasian, 243 (13.8%) were African-American, 13 (0.7%) were Asian, and 68 (3.9%) were "Other".

Information on ethnicity was provided for 1,123 (32.9%) individuals. Of the 1,123 individuals, ninety-one individuals (8.1%) were of Hispanic origin and 1,032 individuals (91.9%) were not of Hispanic origin.

Figure 3. Race Distribution of Work-Related Crushing Injuries, Michigan 2016-2018*



*Information on race was available for 1,761 (51.6%) individuals.

Part of Body Injured

Medical records specified the part of body injured and were classified by ICD-10 codes. Table 3 shows the distribution of the part of body injured. Crushing injuries of upper limbs occurred most often (69.8%), followed by crushing injuries of lower limbs (22.2%).

Table 3. Work-Related Crushing Injuries by Part of Body Injured, Michigan 2016-2018

Part of Body Injured	Number	Percent
Face, Scalp, Neck	54	1.6
Trunk	41	1.2
Upper Limb	2,387	69.8
Lower Limb	758	22.2
Multiple and Unspecified Sites	179	5.2
Total	3,419	100.0

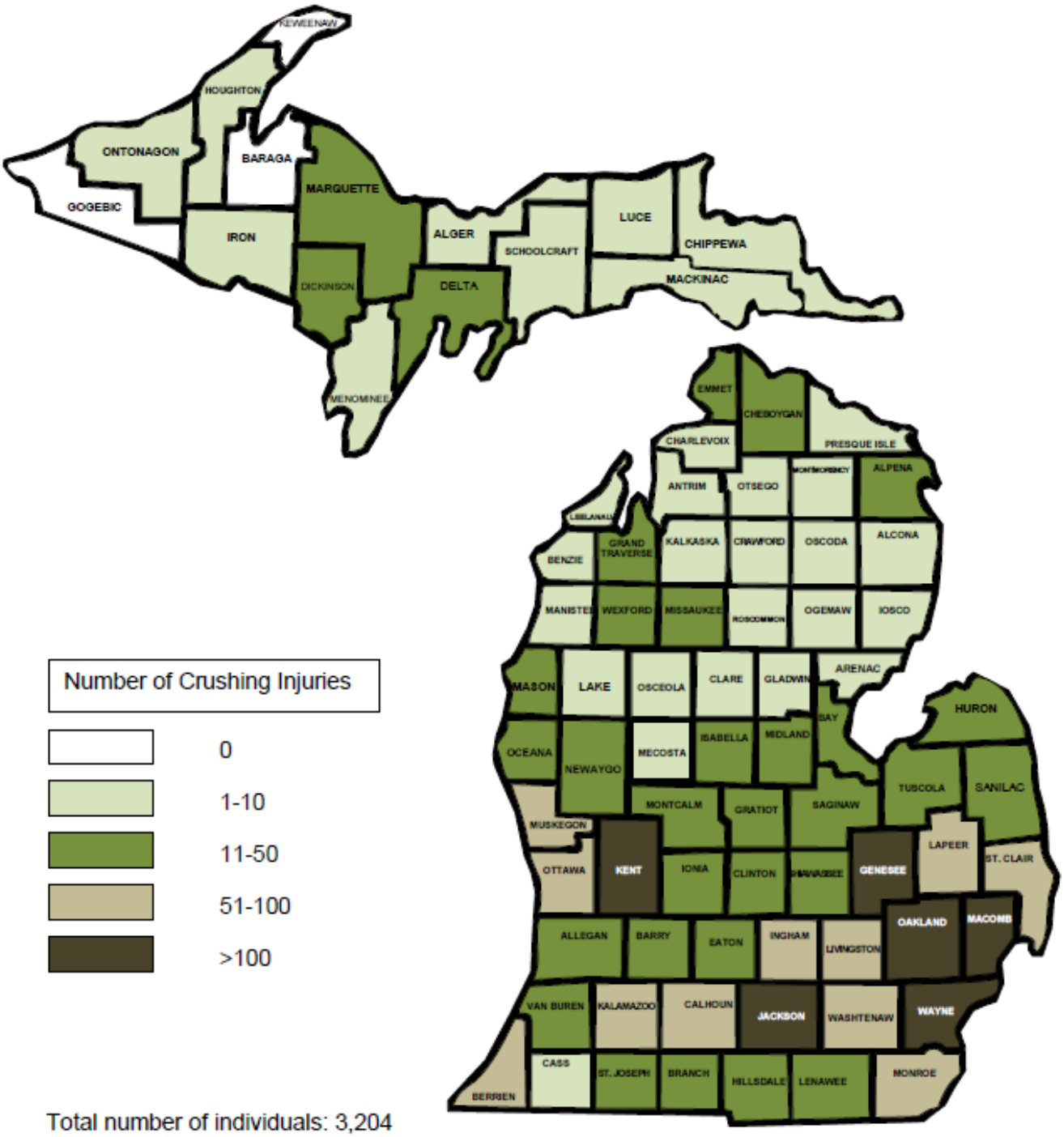
County of Residence

Table 4 and Figure 4 illustrate the worker's county of residence. There were 3,204 Michigan Residents for whom the county of residence was known. There were 80 out-of-state workers, and for 135 Michigan residents the county was unknown. It should be noted that the county of residence would not necessarily be the same county where the individual was injured. Wayne County had the highest number of residents with a work-related crushing injury with 560 (16.4%) cases, followed by Macomb County with 195 (5.7%) cases, and then Oakland County with 171 (5.0%) cases.

Table 4. Work-Related Crushing Injuries by County of Residence, Michigan 2016-2018

	2016 - 2018			2016 - 2018	
County	**Number**	**Percent**	**County**	**Number**	**Percent**
Alcona	2	0.1	Leelanau	3	0.1
Alger	4	0.1	Lenawee	46	1.3
Allegan	31	0.9	Livingston	54	1.6
Alpena	12	0.4	Luce	2	0.1
Antrim	9	0.3	Mackinac	6	0.2
Arenac	8	0.2	Macomb	195	5.7
Baraga	0	––	Manistee	2	0.1
Barry	29	0.8	Marquette	36	1.1
Bay	24	0.7	Mason	16	0.5
Benzie	5	0.1	Mecosta	8	0.2
Berrien	53	1.	Menominee	3	0.1
Branch	46	1.3	Midland	18	0.5
Calhoun	98	2.9	Missaukee	13	0.4
Cass	1	0.3	Monroe	53	1.6
Charlevoix	8	0.2	Montcalm	45	1.3
Cheboygan	13	0.4	Montmorency	3	0.1
Chippewa	5	0.1	Muskegon	93	2.7
Clare	10	0.3	Newaygo	25	0.7
Clinton	33	1.0	Oakland	171	5.0
Crawford	2	0.1	Oceana	16	0.5
Delta	20	0.6	Ogemaw	3	0.1
Dickinson	46	1.3	Ontonagon	1	0.03
Eaton	41	1.2	Osceola	10	0.3
Emmet	21	0.6	Oscoda	1	0.03
Genesee	135	3.9	Otsego	9	0.3
Gladwin	6	0.2	Ottawa	65	1.9
Gogebic	0	––	Presque Isle	7	0.2
Grand Traverse	31	0.9	Roscommon	8	0.2
Gratiot	14	0.4	Saginaw	48	1.4
Hillsdale	25	0.7	Saint Clair	73	2.1
Houghton	10	0.3	Saint Joseph	33	1.0
Huron	35	1.0	Sanilac	19	0.6
Ingham	68	2.0	Schoolcraft	5	0.1
Ionia	41	1.2	Shiawassee	21	0.6
Iosco	3	0.1	Tuscola	33	1.0
Iron	8	0.2	Van Buren	31	0.9
Isabella	11	0.3	Washtenaw	87	2.5
Jackson	153	4.5	Wayne	560	16.4
Kalamazoo	86	2.5	Wexford	23	0.7
Kalkaska	8	0.2	Out of State	80	2.3
Kent	137	4.0	Unknown	135	3.9
Keweenaw	0	––	Instate Total	3,204	
Lake	3	0.1	Total	3,419	100.0
Lapeer	55	.6			

Figure 4
Work-Related Crushing Injuries by County of Residence, Michigan 2016 - 2018



Total number of individuals: 3,204
Out of state individuals: 80
County was unknown for 135 individuals

NORA Sector Groups

For 2,745 (80.3%) cases, including 69 self-employed individuals, there was sufficient information to determine their National Occupational Research Agenda (NORA) Sector Group classification (Table 5 Manufacturing Sector Group had the highest number of work-related crushing injuries with 977 (35.6%) cases, followed by Services (except Public Safety) Sector Group with 594 (21.6%) cases and then Wholesale and Retail Trade Sector Group with 410 (14.9%) cases. Mining (except Oil and Gas Extraction) Sector Group had the highest rate of crushing injuries with 147.4/100,000 workers, followed by Oil and Gas Extraction Sector Group with 123.5/100,000 workers.

Table 5. Work-Related Crushing Injuries by NORA Sector Groups, Michigan 2016-2018*

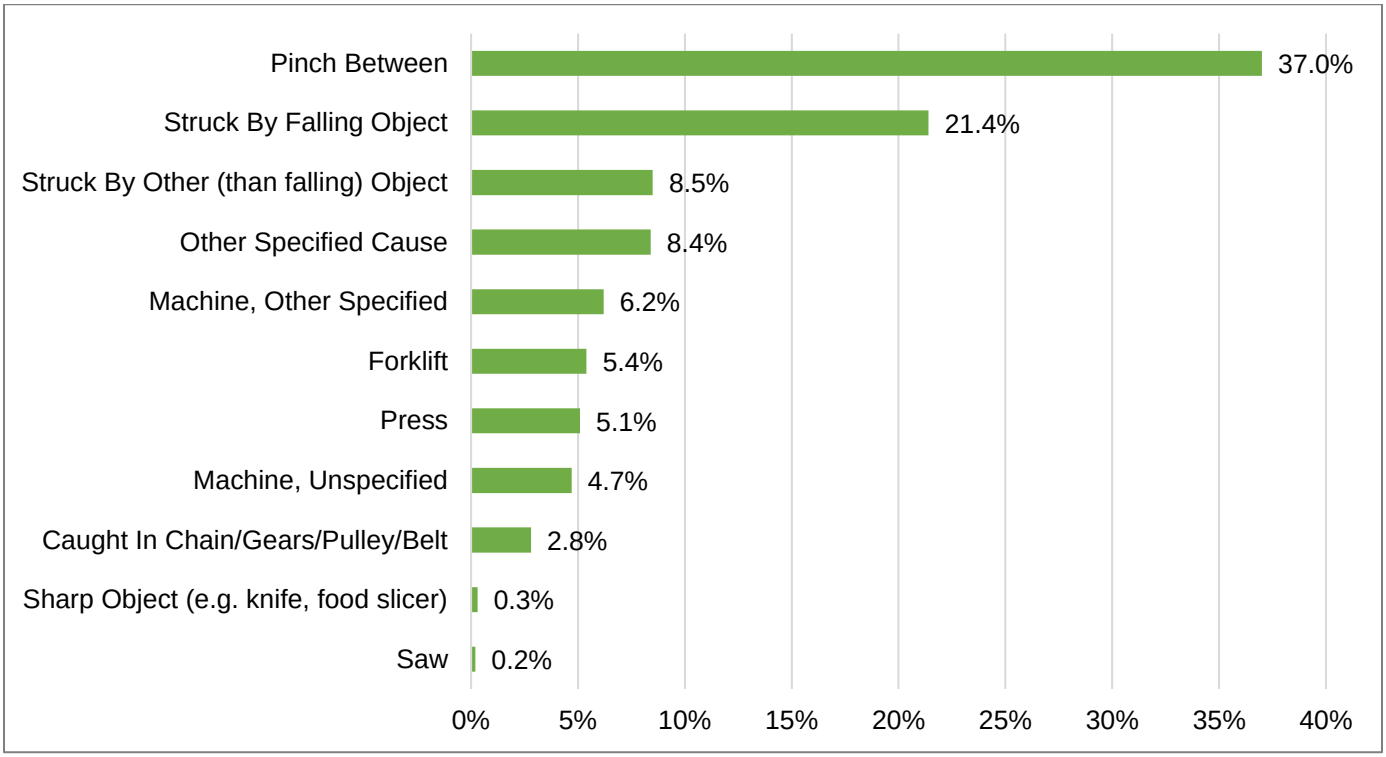
NORA Sector Group	NAICS Code	Number	Percent	Rate[1]
Agriculture, Forestry & Fishing (except Wildland Firefighting)	11	151	5.5	104.7
Construction	23	267	9.7	34.4
Healthcare & Social Assistance	62, 54194, 81291	158	5.8	7.9
Manufacturing	31-33	977	35.6	36.8
Mining (except Oil & Gas Services)	21	10	0.4	147.4
Oil & Gas Extraction	211, 213111, 213112	4	0.1	123.5
Public Safety (including Wildland Firefighting)	92212, 92214, 92216, 62191	22	0.8	7.5
Services (except Public Safety)	51, 52, 53, 54, 55, 56, 61, 71, 72, 81, 92	594	21.6	10.4
Transportation, Warehousing & Utilities	48-49, 22	152	5.5	24.2
Wholesale & Retail Trade	42, 44-45	410	14.9	23.6
Total		2,745	100.0	19.7

*Sufficient information for sector groups classification was available for 2,745 (80.3%) cases.
[1]Rates are the number of workers sustaining a crushing injury per 100,000 workers. Number of workers by NORA Group Sectors used to calculate rates: NIOSH Employment Labor Force Query System

Cause of Crushing Injury

Figure 5 illustrates the cause of work-related crushing injuries. For 431 (12.6%) cases, the cause of injury was not provided in the medical records. The most common cause of crushing injuries was “Pinched between” objects other (than door)” in 1,106 (37.0%) cases, followed by “Struck by falling object” in 639 (21.4%). These two causes of crushing injuries accounted for more than a half of crushing injures for which a cause was provided in medical records.

Figure 5. Cause of Crushing Injuries, Michigan 2016-2018*



*Cause of Crushing Injuries was provided for 2,988 (87.4%) cases

Source of Payment

Workers’ Compensation was the expected payer in 2,185 (71.1%) of the 3,406 work-related crushing injuries for which there was a medical record (Table 6). For 335 crushing injuries payment source could not be identified. Of the 886 cases for which Workers’ Compensation was not listed as a payment source in medical records, 72 were matched to a case in the Workers’ Compensation claims database. Of those 72 cases, 25 were classified as a crushing

injury and 43 had an injury description in the WDCA database as something other than “crushing injury”.

Table 6. Work-Related Crushing Injuries by Payment Source, Michigan 2016-2018*

Expected Source of Payment	All		Non Self-Employed	
	Number	Percent	Number	Percent
Workers' Compensation	2,185	71.1	2,185	73.2
Commercial Insurance	441	14.4	400	13.4
Self-Pay	234	7.6	228	7.6
Medicare/Medicaid	206	6.7	168	5.6
Other Gov’t	5	0.2	5	0.2
Total	3,071	100.0	2,986	100.0

Data Source: Michigan hospital/ED medical records.
*Payment source was unknown for 335 (9.8%) of all cases and for 324 (9.5%) of non-self-employed cases.

MIOSHA Inspections

MIOSHA inspected fifty workplaces where crushing injuries occurred. Table 7 illustrates the distribution of violations and penalties by the NORA Sector Group type. Ninety percent of the workplaces inspected were cited for violations of MIOSHA safety rules. In 42 of the 50 (84.0%) companies, the hazard that caused the crushing injury had not been corrected at the time of the inspection, which was conducted three to six months after the crushing injury occurred.

Table 7. Workplaces Inspected by MIOSHA: Violations and Penalties Assessed by NORA Sector Groups, Michigan 2016-2018

NORA Sector Group	# of Enforcement Inspections	# of Companies Cited	# of Violations	# of Recom-mendations	Total Penalties Assessed
Manufacturing	35	32	75	2	$235,750
Wholesale and Retail Trade	6	4	6	1	$9,700
Services (except Public Safety)	3	3	4	2	$8,100
Agriculture, Forestry & Fishing (except Wildland Firefighting)	2	2	3	0	$3,900
Construction	4	4	9	0	$29,800
Total	50*	45	97	5	$287,250

*Includes five inspections of fatal injuries

Examples of Work-Related Crushing Injury MIOSHA Enforcement Inspections

- *Nursery and Tree Production*

A female in her late twenties sustained a crush injury as well as puncture to the forearm when the arm got stuck in a “planter machine” that picks up plants and dirt, creates a hole, and plants them. Soil and plant matter were injected into the wound, which required antibiotic therapy. MIOSHA found one serious and one other-than-serious violations: “Employees were not properly trained on or protected from the point of operation hazards of being struck-by or caught-in while operating the TTA Transplanter RPE Machine; The firm did not maintain any 300, 300A, or 301 or equivalent forms to record workplace injuries and illnesses.” The company had not corrected the hazard at the time of the inspection.

- *All Other Plastics Product Manufacturing*

A male in his mid-thirties, who worked as a machine operator, died when he was crushed between the platens of a 3,200-ton horizontal injection mold press. His coworker, also a press operator, stopped the press, which was operating in automatic mode, to permit the descendant to enter the press area to retrieve parts that were dropped into the press area onto a floating floor. The descendant entered the press, picked up the parts, and threw them outside the press. The operator restated the press, while the descendent was still in the press area. The descendent was crushed between the closing platens. MIOSHA found four serious violations: “There was no training provided to an employee on hazards and safeguards associated with the operation of the Kraus Maffei Injector Molder; There was a defective presence-sensing floor gate on the Kraus Maffei 3200 Ton horizontal injection molding machine. The presence-sensing floor grate interlock was not functioning, the device did not fail safe and the machine control did not indicate presence of an employee inside of the point of operation. The presence-sensing floor grate interlock was not functioning on the Krauss Maffei 3200 Ton horizontal injection molding machine. The presence-sensing floor grate was not constructed to fail safe in the event of a component failure. All four of the limit switch roller plungers were sheared off. There was no indication on the machine control that the presence-sensing floor grate detected the presence of an employee inside of the point of operation on the Krauss Maffei 3200 Ton horizontal injection molding machine; There was no secondary activation device available or utilized when the Krauss Maffei 3200 Ton horizontal injection molding machine was operated in manual mode. A second employee enters the point of operation to retrieve completed parts from the mold.” The company had not corrected the hazard at the time of the inspection.

- *All Other Miscellaneous General Purpose Machinery Manufacturing*

A male in his mid-twenties was in the process of dismantling a hydraulic press to be refurbished when he sustained a crushing injury to his hand. Components, wiring were not yet present on this machine to connect to a power source. The upper crown and columns had already been removed in the first steps of dismantling the press. The employee had removed all of the bolts on the shaft guide to the platen and was preparing

to lift it from the machine by means of an overhead crane. The machine build leader came by and recommended that the swing arm support be removed first. The bolts to the swing arm were positioned adjacent to a support block (angle iron) that was holding up/supporting a cylinder (upper cannon shooter). The angle iron (block) was blocking access to the bolts of the swing arm. The employee used a hammer to knock the support block out of the way to access the bolts, forgetting that the upper cannon shooter or cylinder was no longer secured and was supported solely by the piece of angle iron. The cylinder dropped down suddenly onto his fingers causing a crushing and amputation injury. The employee was hospitalized for two days. MIOSHA found two serious violations and one regulatory notice type of violation: “The angle iron block placed under cannon shooter/cylinder on the Hydraulic Hem Press SA 250 in Bay C was the sole means of support as employee was in the process of dismantling the machine. All bolts had previously been removed from the platen that was holding the cylinder in a raised position. The employee removed the support block to access the swing arm when the cylinder dropped onto his fingers; Head protection was not worn by the employees operating the 15 Ton Overhead Cranes in the build area. The crane was observed in use with the top of the load at about 8 feet high; The employer did not report the hospitalization of employee who sustained injuries.” The company had not corrected the hazard at the time of the inspection.

Figure 6. Pictures of the hydraulic press

- *Supermarkets and Other Grocery (except Convenience) Stores*

A male in his late sixties sustained a crushing injury to the right hand as a result of his hand's being caught, while inserting meat, in a cubing machine (which used metal rollers with teeth to grind meat). The employee was able to stop the machine and pull his fingers out but after they were crushed. MIOSHA found one serious violation: "The guard was not put in place on the Sir Steak BIRO machine in the kitchen before operating it." The company had not corrected the hazard at the time of the inspection.

- *Other Spectator Sports*

A male in his late fifties, employed at a car racing track, sustained a crushing injury as a result of his hand getting caught in a lathe/metal cutting machine. Injuries included several fractures to his hand, involving an open fracture with partial degloving, and multiple lacerations with exposed bone, nerves, and tendons. MIOSHA found two other-than-serious violations, including: "An employee inpatient hospitalization resulting from a work-related injury was not reported to MIOSHA within 24 hours of the incident; There was no MIOSHA poster posted in the facility." MIOSHA's investigation of the worksite revealed the following condition that may constitute a safety hazard to the company's employees and made the following recommendation: "During the investigation, it was discovered that employees perform "Parting" tasks on industrial metalworking lathes. "Parting" requires

an employee to operate the manual feed dial on the parting tool with the left hand while reaching near the rotating sock with their right hand in order to catch the finished part before it drops into the coolant/chip bed area. It is recommended that a part catcher, or basket be installed in this location to catch finished parts. This would eliminate the need for employees to place their hands near the rotating parts and avoid similar injuries as well as eliminate parts from falling into the coolant/chip bed area."

- *Other Building Finishing Contractors*

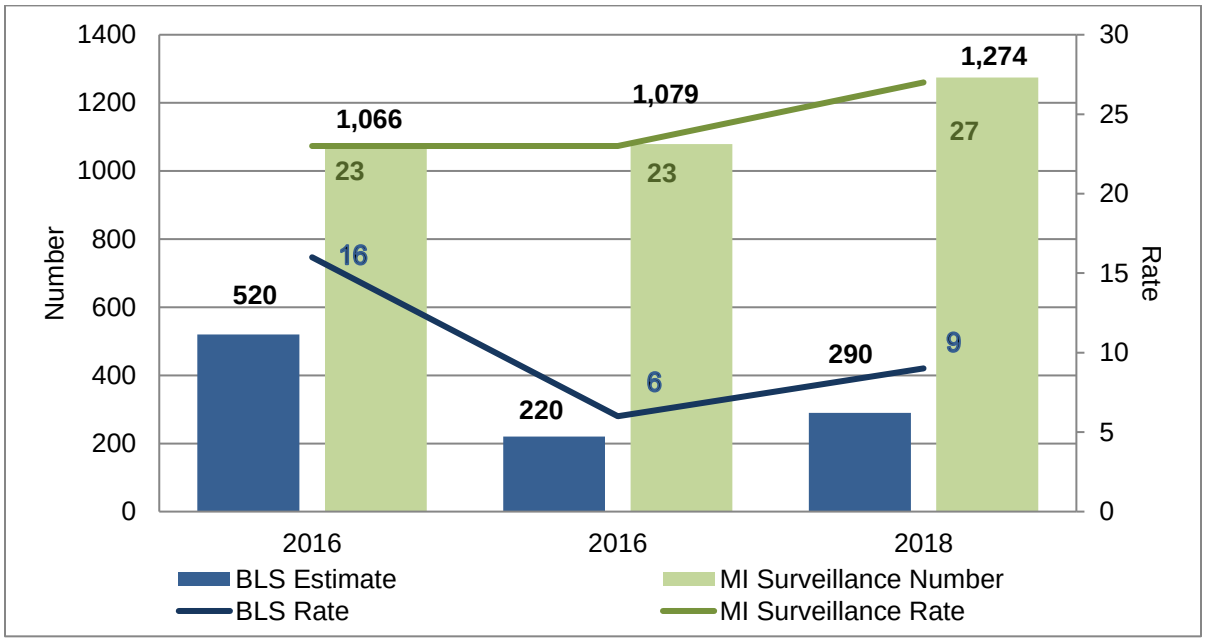
An 18-year-old male was six feet down in a trench next to a house foundation when a section of the clay trench wall fell onto him, trapping his left leg up to the hip. The worker sustained crushing injuries to his left leg, foot and torso. It took the Fire Department two hours to dig the worker out. MIOSHA found three violations: "A) The accident prevention program did not provide for adequate instruction to each employee regarding the operating procedures, hazards, and safeguards of tools and equipment when necessary to perform the job. B) There were no adequate inspections of the construction site, to assure that unsafe conditions which could create a hazard are eliminated. C) Adequate instruction to each employee in the recognition and avoidance of hazards and the regulations applicable to his or her work environment to control or eliminate any hazards or other exposure to illness or injury was not provided; The employer did not have a qualified person conducting an ongoing inspection of the trench; The sides of the excavation were not cut to proper angle of repose – no shoring – no trench box. One excavation was approximately 31-feet long and 6-feet deep. The width at the bottom was 2-feet. Width at the top was 2.5-feet. The west side of the excavation was at 90 degree angle. North, South, and East sides of excavation were an 85 degree angle." The company had not corrected the hazard at the time of the inspection.

DISCUSSION

This is the second report on work-related crushing injuries in Michigan. It covers three calendar years, 2016 through 2018. The Michigan surveillance system for work-related crushing injuries provides a more accurate estimate of the true number of work-related crushing injuries than the employer-based reporting system maintained by BLS, which is the source of official statistics. For years 2016 through 2018, the Michigan system

identified 3,419 work-related crushing injuries in comparison to 1,030 estimated by BLS (Figure 7). The employer-based system identified a much smaller estimate (30.1%) than the Michigan system. BLS' rates of crushing injuries per 100,000 full time equivalents are smaller (16 in 2016, 6 in 2017 and 9 in 2016) and show a downward trend in comparison to the upward trend of the rates of crushing injuries identified in the Michigan multi-source surveillance system (23 in 2016, 23 in 2017 and 27 in 2018). Workers' Compensation identified a larger number of work-related contusions/crushing injuries than BLS because contusions are given the same code as crushing injuries, and therefore since they cannot be separated in the Michigan Workers' Compensation database from crushing injuries are included in the Workers' Compensation count of crushing injuries. The BLS' estimates differentiate crushing injuries from bruises/contusions.

Figure 7. Number and Rate of Work-Related Crushing Injuries Comparing BLS and MI Surveillance, Michigan 2016-2018



For 2016 through 2018 BLS estimated only 30.1% of the 3,419 work-related crushing injuries reported in the Michigan's multi-source reporting system. This is a much smaller estimate than for 2013 through 2015, for which BLS estimated 40% of the 3,137 crushing injuries reported in Michigan's multi-source reporting system. The criteria to obtain the estimate were the same for all years. The reason for the decrease in the BLS estimate of work-related crushing injuries for Michigan was unknown.

The BLS's undercount of work-related crushing injuries 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 all work-related crushing injuries. Secondly, the BLS excludes self-employed, household employees and farm workers who work on farms with less than 11 employees. Michigan's crushing injuries surveillance identified only 101 self-employed individuals in 2016 through 2018, and 151 farmers during the three years of surveillance with work-related crushing injuries so the difference in the type of workers covered in the BLS survey 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 reporting, or the statistical sampling procedure of BLS, or employers, are not properly identifying employees' injuries as crushing injuries. 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.

Workers' Compensation was identified as the payer for only 71% of the work-related crushing injuries treated at Michigan hospital and emergency department in 2016 through 2018. Another 85 (2.8%) were not covered by workers' compensation (i.e. self-employed). We do not know the reasons why for the other 26% of the hospitalizations/ED visits worker compensation was not listed as the payer.

The Workers' Compensation database identified only 681 (19.9%) of the 3,419 work-related crushing injuries. The possible explanations for the Workers' Compensation difference include: 1) The WDCA data set only included crushing injuries that caused seven or more consecutive days away from work, presumably the most severe cases; 2) WDCA excluded the self-employed, but again there were only one hundred and one self-employed workers in 2016 through 2018 in Michigan' multi-source reporting system; 3) Coding or miscoding errors in the WDCA data. The matching with hospital records showed that 438 work-related crushing injuries identified from medical records were not classified as crushing injuries in the WDCA data. Potentially there were other injuries in the WDCA database that were similarly misclassified but for which no medical records were received; 4) Workers' Compensation Condition Type Code combined crush and

contusion injuries into one code with no possibility to differentiate those two injury types; 5) It is possible that some companies are handling crushing injuries unofficially and not reporting them to Workers' Compensation insurance companies or the WDCA.

Surveillance of work-related crushing injuries is crucial to the recognition and prevention of these conditions. A large advantage of the Michigan surveillance system is that it not only provides a better count of the total number of work-related crushing injuries but the reports can also be used to identify specific workplaces to perform follow back investigations. Between 2016 and 2018, fifty worksites were identified by the surveillance data with a subsequent intervention by MIOSHA to reduce the hazard of a future work-related crushing injury or other serious injury to other employees. Ninety percent (45) of the inspected companies were cited, and despite a serious injury at those workplaces, 84% of these companies had not corrected the hazardous situation months after the injury.

We have developed educational materials for distribution to employers and employees where we see patterns in causes for work-related injuries (https://oem.msu.edu/index.php/work-related-injuries/miface-hazard-alerts).[16] A hazard alert on crushing injuries from presses has been developed (https://oem.msu.edu/images/Alerts/2020/Press_Crush.pdf).[17] Development and distribution of this information allows employers to work with employees to implement effective prevention strategies for injuries at more facilities than where a MIOSHA inspection was performed.

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