Work-Related Farm Injuries in Michigan: Second Report (January 2017 – December 2019)

MICHIGAN STATE
U N I V E R S I T Y

Department of Medicine

909 Wilson Road

Room 117 West Fee Hall

East Lansing, MI 48824

April 19, 2021

Work-Related Farm Injuries in Michigan:

Second Report

(January 2017 – December 2019)

Michigan State University

Joanna Kica, MPA
Kenneth Rosenman, MD

Author affiliations: Joanna Kica and Kenneth Rosenman are with Michigan State University, Department of Medicine, 909 Wilson Rd., Room 117 West Fee Hall, East Lansing, MI 48824.

Acknowledgement: Funding provided by the United States Department of Agriculture (USDA) (Award # 2018-41590-28722), and the National Institute for Occupational Safety and Health (NIOSH) (Award # 2U60OH008466).

TABLE OF CONTENTS

Executive Summary……1

Background……...2

Data Sources and Methods……3

Results……...6

Type of Medical Encounter..……7

Characteristics of Injured Farm Operators, Working Family Members, Hired Hand and Migrant Workers……...8

Age and Gender…..……...8

Race and Ethnicity……...9

Part of Body Injured…...……11

Injury Source……..12

Nature of Injury……..13

Occupation Type……...14

County of Residence and County of Farm……15

Farm Type……20

Month of Medical Encounter and Farm Type by Seasonality……...21

Source of Payment……..22

Industrial Hygiene Inspections..……...23

Discussion……...24

References……..27

EXECUTIVE SUMMARY

Michigan State University's Occupational and Environmental Medicine Division compiles data on work-related farm injuries in the state of Michigan. This is the second report on occupational farm-related injuries in Michigan; it covers three years, 2017, 2018 and 2019. These are the key findings:

- Work-related farm injuries were identified through hospital medical records
  - In 2017, there were 812 work-related farm injuries in 805 individuals.
  - In 2018, there were 730 work-related farm injuries in 724 individuals.
  - In 2019, there were 621 work-related farm injuries in 612 individuals.
  - Over the three years combined, there were 2,163 work-related farm injury incidents in 2,111 individuals; 19 individuals each sustained two farm injuries in the same calendar year, 25 individuals sustained two farm injuries in two separate calendar years, 3 individuals sustained two farm injuries in one calendar year and another injury in a separate calendar year, and one individual sustained three farm injuries in three separate calendar years.
- The most common type of medical encounter was an emergency department visit (1,791; 82.8%).
- Seventy-five percent of all farm-related injuries were among men; 90.8% were among Caucasians.
- The most common part of the body injured was an upper limb (769; 37.4%), followed by a lower limb (541; 26.3%).
- The most common types of injury were contusions (410; 19.1%) and fractures (405; 18.8%) which together accounted for over a third of all farm injuries.
- Injuries caused by cows were the predominant cause of work-related farm injuries and accounted for almost a third (594; 28.9%) of all injuries. Dairy farms accounted for 37.4% of all cases for which the farm type was recorded by a health care provider.
- Owners/operators accounted for 51.8% and hired hand for 34.3% of all individuals working on a farm.
- Commercial insurance was the expected payer in 644 (38.0%) cases, followed by Medicare/Medicaid in 580 (34.2%) cases.

BACKGROUND

Report purpose: This is the second report on work-related farm injuries in Michigan. The report is based on data for years 2017, 2018 and 2019.

Michigan State University's College of Human Medicine, Occupational and Environmental Medicine Division operates the farm-related injuries surveillance system as the bona fide agent for the State. The Michigan work-related farm injuries surveillance system uses data from Michigan hospitals and the Michigan Workers Compensation system to identify cases of work-related farm injuries and their causes, and to target interventions to reduce these injuries and evaluate the effectiveness of interventions.

Background on agricultural injuries: The agriculture industry is one of the most hazardous industries, where farm operators and workers have a high rate of work-related fatalities. Farm-related injuries, like all occupational injuries, are potentially preventable. Health professionals and health facilities are required to report individuals with all injuries, including farm injuries, regardless of cause, when requested by the Michigan Department of Health and Human Services (MDHHS). 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".[1]

According to the U.S. Department of Agriculture 2017 Census of Agriculture for Michigan, there were 47,641 farms in Michigan with 80,432 producers, 77,475 hired farm labor including migrant and seasonal laborers, and 54,839 unpaid workers.[2] The term producer designates a person who is involved in making decisions for the farm operation; the producer may be the owner, a member of the owner's household, a hired manager, a tenant, a renter, or a sharecropper. Hired farm labor includes all hired farm workers, including paid family members, bookkeepers, office workers, maintenance workers, etc., if their work was primarily associated with agricultural production. Hired farm workers excludes contract laborers. The Census divides hired farm workers into two categories based on the duration of work in a calendar year: working 150 days or more (27,177

workers) or less than 150 days (50,298 workers). Unpaid workers include agricultural workers not on the payroll who perform activities or work on a farm or ranch (family members). The number of migrant workers was not noted on the 2017 Agricultural Census, only that there were 828 farms utilizing migrant labor.

DATA SOURCES AND METHODS

All 134 of Michigan's acute care hospitals, including Veterans' Administration Hospitals, were required to report work-related farm injuries. Discharge summaries and Emergency Department (ED) notes were reviewed to differentiate the work and non-work-related farm injuries treated at a hospital/emergency department or as an outpatient visit at a hospital-based clinic. Cases reported either received medical treatment at a Michigan hospital/ED/hospital outpatient clinic for:

(a) A farm injury-related ICD-10-CM diagnosis code[3] (Table 1), and
(b) The incident was recorded as having occurred while working on a farm. Injuries related to activity around the home even though the home was typically on the farm were not included.

OR

A report from the Poison Control Center (PCC) when a call was made regarding a consultation for a work-related farm exposure.

Table 1. Farm Injury ICD-10 Diagnosis Codes

ICD-10 Code	Description
T60 (excluding T60.0X2, T60.1X2, T60.2X2, T60.3X2, T60.4X2, T60.8X2, T60.92), Z57.4	Pesticides excluding intentional self-harm, Agricultural Chemical Poisoning
V80, V84	Animal-Drawn Vehicle Accidents
Y92.7	Place of Occurrence - Farm
W55.2-.4	Other Injury Caused by Animal
W30	Accidents Caused by Agricultural Machinery

Information from the hospital/ED medical reports and PCC reports on each case were abstracted, including: type of medical care (hospital overnight, ED, outpatient, PCC call), hospital name, date of admission and discharge, patient demographics, city and county of residence, source of payment, occupation type (owner/operator/producer; family member, hired hand (except migrant worker), migrant worker, other (e.g. a friend, neighbor)), farm information (type, name, address), part of body injured, cause of injury, nature of injury. Once these farm injury data were entered into a Microsoft Access database, records were manually linked to records in the Workers' Compensation database. The Michigan Workers' Disability Compensation Agency (WDCA) provided access to a database of workers who received 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. Matches were identified using each individual's first and last name, date of birth and date of injury/date of hospital admission. Information from Workers' Compensation on 130 matched cases was added to the database.

Farm operators and workers in the surveillance system, who qualified for services from program called "Michigan AgrAbility" based on the severity of injury, received a letter and a brochure informing them about the Michigan AgrAbility program.[4] Michigan AgrAbility is a program of Michigan State University Extension and Easterseals of Michigan, a private charity, which designs specific adaptive tools and provides on-farm services to farmers with injury, illness or disability so they can continue to work.

The criteria for a referral to Michigan OSHA were: 1) the individual had to be an employee; 2) the individual had to be hospitalized, treated in an emergency department or as an outpatient at a hospital in 2017, 2018 or 2019; 3) the circumstances of the injury suggested there was an ongoing hazard; and 4) the farm injury occurred in the last six months.

For cases inspected by Michigan OSHA, additional information was obtained about the results of the inspection: inspection date, whether the hazard causing the farm 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. Farm injury Agriculture Industry rates were calculated using the U.S. Department of Agriculture's 2017 Census of Agriculture for Michigan.[2] The denominator used was 212,746: the total of 80,432 producers, 77,475 hired farm labor, and 54,839 unpaid workers.[*] A small number of individuals sustained more than one injury in the three-year period; unless specified otherwise, data were analyzed by counts of injuries, not counts of individuals.

There are a number of issues associated with summing up the counts of hired labor, unpaid workers, and migrant/seasonal laborers in the denominator. According to the U.S. Department of Agriculture 2017 Census of Agriculture for Michigan, 760 farms indicated that they utilized migrant workers as part of their hired workers and 68 farms reported that they did not have hired farm workers, but they did have migrant contract workers on their operation. This indicates that these estimates may contain a classification error and/or classification overlaps, in which a farm worker may be counted more than once in different categories.

For the purpose of this report, migrant workers with farm-related injuries/illnesses are a separate category of hired hand workers and were counted separately. Category "workers" includes owner/operators, hired hand, migrant workers and family members.

[*]The USDA uses the following definitions: "Producer" is a person making decisions for the farm operation- the owner, a member of the owner's household, hired manager, tenant, renter, or sharecropper. "Hired farm labor" includes all hired farm workers, including paid family members, bookkeepers, office workers, etc., and excluding contract laborers. "Unpaid workers" include those not on the payroll who perform activities or work on the farm (family members).

For comparison, the numbers and incidence rates of nonfatal occupational injuries and illnesses by industry and case types were available from the BLS Survey of Occupational and Injuries and Illnesses (SOII).[5] SOII provides estimates and incidence rates for nonfatal cases of work-related injuries and illnesses from participating States, including Michigan, that are recorded by employers under the Occupational Safety and Health Administration's (OSHA's) recordkeeping guidelines. BLS provided numbers and rates for the Agriculture, Forestry, Fishing and Hunting Industry (NAICS code[6] 11), and two subindustries: Crop Production (NAICS code 111) and Animal Production and Aquaculture (NAICS code 112). The number of injuries in the Agriculture Industry, excluding Forestry, Fishing and Farming, is a sum of the total number of injuries in the Crop Production and the Animal Production and Aquaculture. The incidence rate in the Agriculture Industry, excluding Forestry, Fishing and Farming represents the number of injuries per 100 full-time workers and were calculated as: (N/EH) x 200,000, where: N = number of injuries in the Crop Production and the Animal Production and Aquaculture; EH = total hours worked by all employees during the calendar year in the Crop Production and Animal Production and Aquaculture; 200,000 = base for 100 equivalent full-time workers (working 40 hours per week, 50 weeks per year).

The BLS Occupational Injuries, Illnesses and Fatal Injuries Profiles online tool was used to generate the 2017, 2018 and 2019 BLS estimates of the number of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and occupation for both private and public ownerships.[7] Code 452000 (Agricultural Workers) was used to generate the estimates.

RESULTS

In 2017, there were 812 work-related farm injuries in 805 individuals because seven individuals had two farm injuries. The rate was 381.6/100,000. In 2018, there were 730 work-related farm injuries in 724 individuals because six individuals each had two farm injuries. The rate was 343.1/100,000 workers. In 2019, there were 621 work-related farm injuries in 612 individuals because nine individuals had two farm injuries. The rate was

287.6/100,000 workers. Nineteen individuals sustained two injuries in one calendar year, twenty-five individuals sustained two farm injuries in two separate calendar years, three individuals sustained two farm injuries in one calendar year and another injury in a separate calendar year, and one individual sustained three farm injuries in three separate calendar years (Table 2).

2017-2019 Combined: There were 2,163 work-related farm injuries in 2,111 individuals because nineteen individuals each sustained two farm injuries in the same calendar year, twenty-five individuals had a farm injury in two separate calendar years, three individuals had three injuries in one calendar year and in a separate calendar year, and one individual had three injuries in three separate calendar years.

Table 2. Work-Related Farm Injuries by the Number of Individuals, Injuries and Injury Rates, Michigan 2017-2019

Year	Number of Individuals	Number of Injuries	Injury Rate[1]
2017	805	812	381.6
2018	724	730	343.1
2019	612	621	287.6
2017-2019	2,111[2]	2,163	337.4

[1]Farm injury rates were calculated using the U.S. Department of Agriculture's 2017 Census of Agriculture for Michigan. Injury rates are the number of workers sustaining a farm injury per 100,000 workers.

[2]Total number of injured individuals in the three-year-period is 2,111; forty-four individuals sustained two unique injuries and four individuals sustained three unique injuries during the three-year-period.

Type of Medical Encounter

An emergency department visit was the most common type of medical encounter: 1,791 (82.8%) injuries (Table 3). Eleven percent of individuals were hospitalized due to the farm injury they sustained, and 3.1% were seen at a hospital based clinic. The remaining 2.7%

of work-related farm injuries received another type of medical care such as PCC consultation or outpatient surgery.

Table 3. Work-Related Farm Injuries by the Type of Medical Encounter, Michigan 2017-2019

Medical Encounter Type	Number	Percent
Emergency Department	1,791	82.8
In-patient Hospitalization	246	11.4
Hospital Outpatient	68	3.1
Other*	58	2.7
Total	2,163	100.0

*Other includes PCC consultations, outpatient surgery records and other unspecified medical care visits.

Characteristics of Injured Farm Operators, Working Family Members, Hired Hands and Migrant Workers

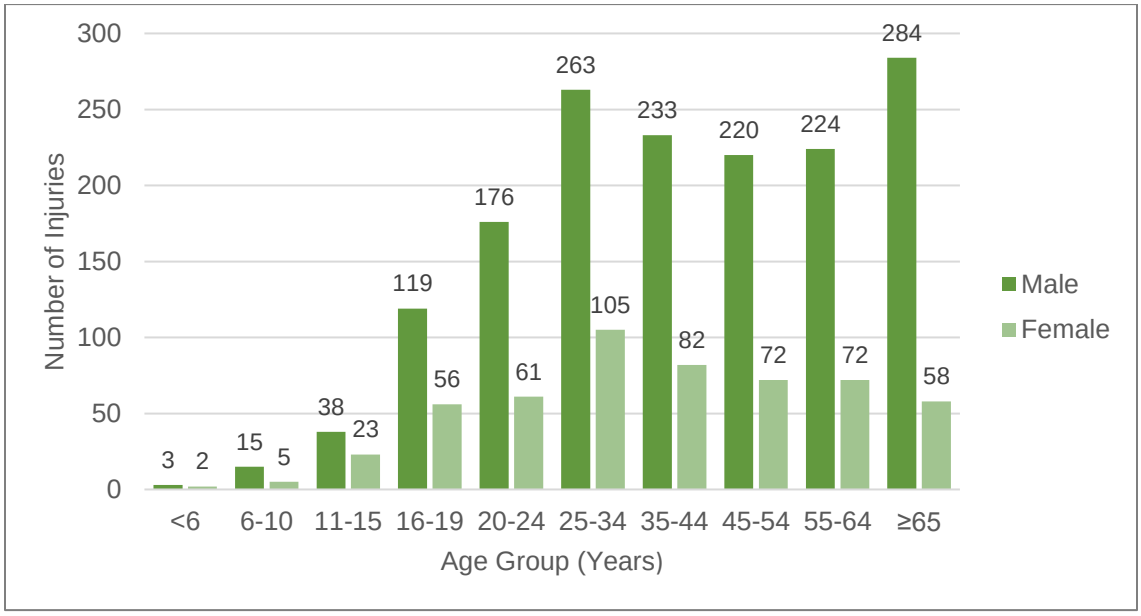
Age and Gender

The age of injured farm operators and workers varied from 4 to 98 years. The average age was 42.6 and the median age was 40.0. One thousand five hundred and seventy-five (74.6%) of all work-related farm injuries were among men. Figure 1 displays farm injuries by age group and gender. Among males, the most injuries were in the 65+ and 25-34 age groups, 284 and 263, respectively. For females, the age groups with the highest number of farm injuries were 25-34 and 35-44 with 105 and 82 injuries, respectively.

There were twenty-five children 10 years and under injured while performing chores on a farm. Examples of causes of injuries while children were doing farm chores included: having a hand caught in an auger while dispensing animal feed; falling off a wagon while helping bale hay; stepping on a pitch fork while cleaning a chicken coop; assisting a cow into a pen to be milked when it turned abruptly and hit the nine-year-old girl with its head knocking her down on her back and then stepping on her head; having a foot struck by a bucket that had fallen off from a tractor; having a finger caught in and pinched by an

auger; being knocked over by a goat that than stepped on the child's elbow; falling 10-12 feet off a ledge while baling hay; having a foot run over by a tractor while working in an orchard; being kicked by a calf while walking it.

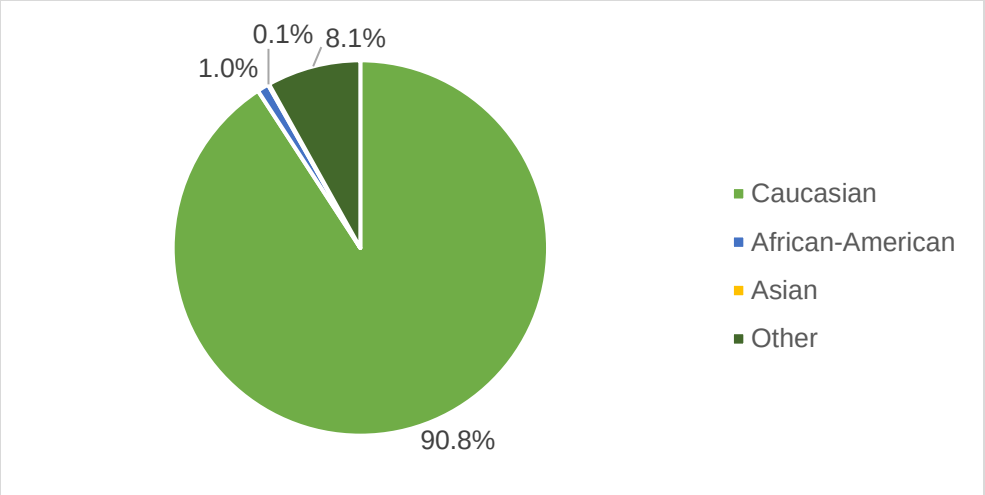
Figure 1. Work-Related Farm Injuries by Age Groups and Gender, Michigan 2017-2019



Race and Ethnicity

The race of farm operators and workers with work-related farm injuries was available for 1,041 (49.3%) of the individuals; 946 (90.8%) were Caucasian, 10 (1.0%) were African-American, 1 (0.1%) were Asian, and 84 (8.1%) were "Other" (Figure 2).

Figure 2. Race Distribution of Work-Related Farm Injuries, Michigan 2017-2019*



*Information on race was available for 1,041 (49.3%) individuals.

Information on ethnicity was provided for 614 (29.1%) individuals. Of the 614 individuals, 176 individuals (28.7%) were of Hispanic origin. Hispanic workers were more likely to be hired hand (60.3%) and migrant workers (33.6%) than non-Hispanic workers who were more likely to be owner/operators (61.9%) (Table 4). Most farm injuries in Hispanic workers occurred on dairy farms with 55 (40.1%) cases, and most injuries in non-Hispanic workers occurred on livestock farms with 71 (35.1%) cases (Table 5). Injured Hispanic workers were more likely to have worked on fruit and vegetable farms (28.4%) than non-Hispanic workers (10.9%) were and less likely to have worked in all other types of farms than non-Hispanic workers.

Table 4. Hispanic and Non-Hispanic Workers by Occupation Type and Farm Type, Michigan 2017-2019

Occupation Type[1]	Hispanic Workers		Non-Hispanic Workers	
	Number	Percent	Number	Percent
Hired hand	88	60.3	84	22.5
Migrant worker	49	33.6	1	0.3
Owner/operator	8	5.5	231	61.9
Family member	1	0.7	57[3]	15.3
Total	146	100.0	373	100.0
Farm Type[2]	**Hispanic Workers**		**Non-Hispanic Workers**	
	Number	Percent	Number	Percent
Dairy	55	40.1	49	24.3
Fruit	28	20.4	14	6.9
Livestock	18	13.1	71	35.1
Other	17	12.4	38	18.8
Vegetable	11	8.0	8	4.0
Poultry	8	5.8	7	3.5
Grain	0	–	15	7.4
Total	137	100.0	202	100.0

[1]Information on both ethnicity and occupation type was available for 519 (84.5%) individuals.

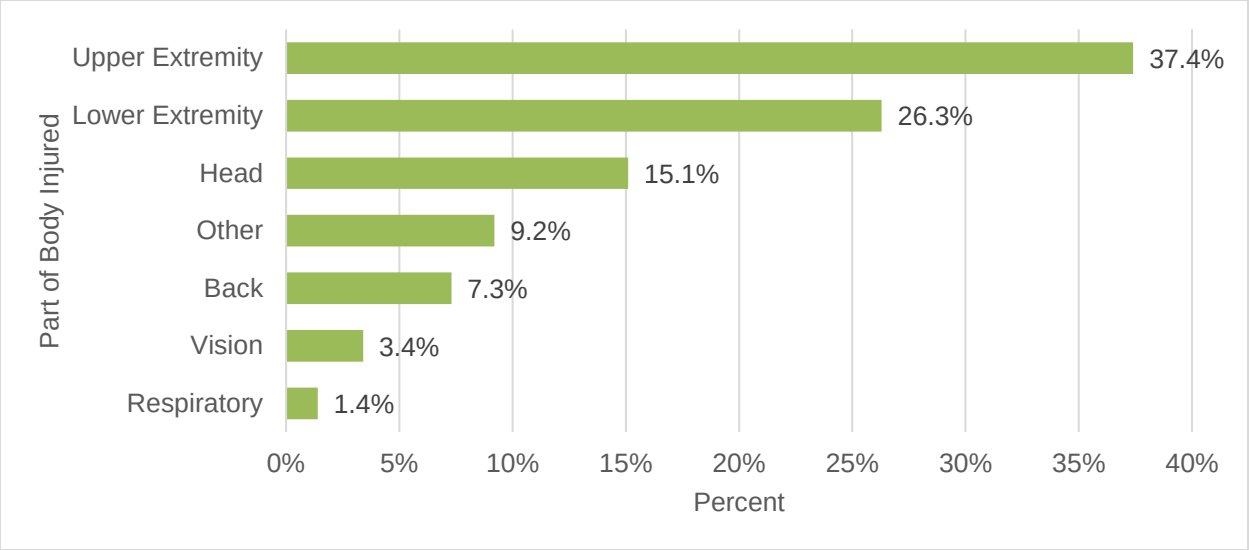
[2]Information on both ethnicity and farm type was available for 339 (55.2%) individuals.

[3]Includes 6 individuals who were not family members but provided non-paid assistance on a farm.

Part of Body Injured

Figure 3 shows the distribution of the part of body injured by the primary ICD-10 code and/or primary description in the discharge summary identified in the medical records. Farm injuries of upper limbs occurred most often (37.4%), followed by injuries of lower limbs (26.3%).

Figure 3. Work-Related Farm Injuries by Part of Body Injured, Michigan 2017-2019*



*Information on part of body injured was available for 2,057 (95.1%) of injuries. Percentages are based on the primary diagnosis of the injury.

Injury Source

For 2,055 (95.0%) injuries, the source of the injury was provided in the medical records (Table 5). Injuries caused by cows were the most common and accounted for almost a third of all injuries (594, 28.9%). The next most common sources were injuries from machines other than a tractor (e.g., combine, corn husker, auger, hay baler) and from tractors, with 200 (9.7%) and 180 (8.8%) injuries, respectively (Table 6). Category “Other” contained different types of injury sources that did not fall into the 10 specific categories. Examples of injuries categorized under “Other” category include being struck by a tree branch, being hit in the face by a metal gate, having a hand burned by steam while evaporating maple syrup, lifting a 75-pound-bag to feed animals, being hit by a hay bale.

Table 5. Work-Related Farm Injuries by Injury Source, Michigan 2017-2019*

Injury Source	Number	Percent
Cow	594	28.9
Non Tractor Machine	200	9.7
Tractor	180	8.8
Fall at Ground Level	178	8.7
Fall from Hight	166	8.1
Livestock	99	4.8
Chemical	77	3.7
Tool	67	3.3
Horse	59	2.9
Poultry	6	0.3
Other	429	20.9
Total	2,055	100.0

*Information on injury source was available for 2,055 (95.0%) injuries.

Nature of Injury

The most common type of injury was a contusion (bruise), in 19.1% of cases, followed by fractures, in 18.8% of cases (Table 6). These two natures of injury accounted for over a third of all types of injuries identified.

Table 6. Work-Related Farm Injuries by Nature of Injury, Michigan 2017-2019*

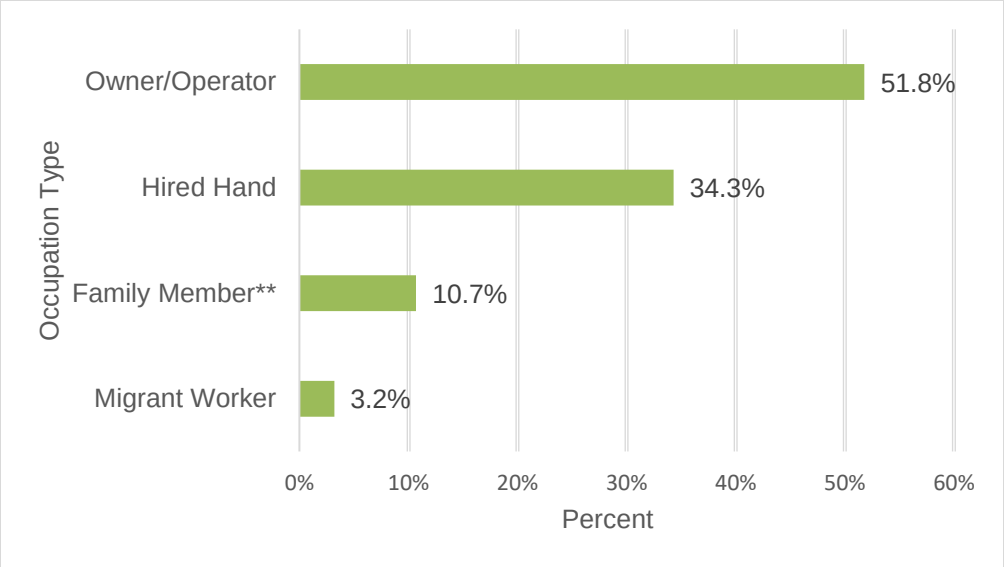
Nature of Injury	Number	Percent
Contusion/Bruise	410	19.1
Fracture	405	18.8
Other	336	15.6
Laceration/Cut/Puncture	318	14.8
Sprain/Strain	192	8.9
Crushing Injury	146	6.8
Head Injury (no fractures)	70	3.3
Burn	67	3.1
Amputation	58	2.7
Abrasion	50	2.3
Concussion	42	2.0
Animal Bite/Sting	38	1.8
Dislocation	17	0.8
Total	2,149	100.0

*Information on nature of injury was available for 2,149 (99.4%) injuries. Numbers were based on the primary diagnosis.

Occupation Type

For 78.3% of all medical records, the occupation type was specified. Owner/operators accounted for half (51.8%) of all the individuals injured, followed by hired farm labor (34.3%), family members, including 16 non-paid friends and neighbors who assisted (10.7%) and migrant workers (3.2%) (Figure 4).

Figure 4. Work-Related Farm Injuries by Occupation Type, Michigan 2017-2019*



*Occupation type was specified for 1,652 (78.3%) individuals.
**Includes 16 non-paid friends and neighbors who assisted.

County of Residence and County of Farm

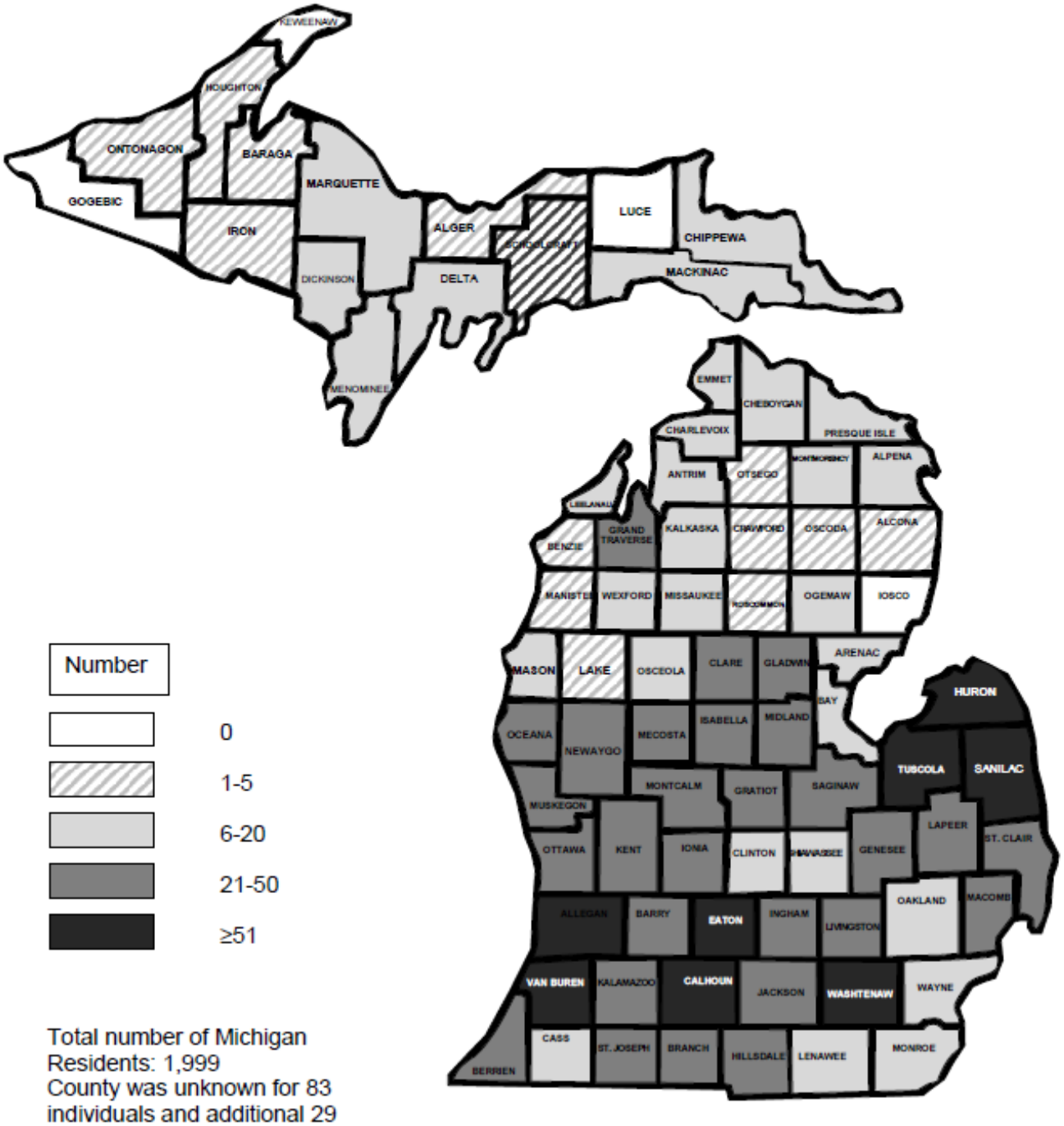
There were 1,999 Michigan Residents for whom the county of residence was known. There were 29 out-of-state workers, and for 83 residents of Michigan county was unknown. It should be noted that the county of residence would not necessarily be the same county where the individual was injured and where the farm was located. Huron County had the highest number of residents with a work-related farming injury with 176 (8.3%) cases, followed by Tuscola County with 120 (5.7%) cases, and then Allegan County with 84 (4.0%) cases (Table 7 and Figure 5).

Information on the county where the farm was located and where injury occurred was specified for only 1,275 (58.9%) injuries (Table 8 and Figure 6). Huron County had the highest number of farm work-related injuries with 104 (4.8%) cases, followed by Tuscola County with 64 (3.0%) cases, and then Van Buren County with 56 (2.6%) cases.

Table 7. Number and Percent of Individuals with Work-Related Farm Injuries by County of Residence, Michigan 2017-2019

Michigan County	2017-2019		Michigan County	2017-2019	
	Number	Percent		Number	Percent
Alcona	5	0.2	Leelanau	17	0.8
Alger	4	0.2	Lenawee	15	0.7
Allegan	84	4.0	Livingston	29	1.4
Alpena	17	0.8	Luce	0	–
Antrim	13	0.6	Mackinac	14	0.7
Arenac	14	0.7	Macomb	25	1.2
Baraga	2	0.1	Manistee	3	0.1
Barry	22	1.0	Marquette	8	0.4
Bay	11	0.5	Mason	13	0.6
Benzie	2	0.1	Mecosta	24	1.1
Berrien	46	2.2	Menominee	6	0.3
Branch	38	1.8	Midland	26	1.2
Calhoun	59	2.8	Missaukee	9	0.4
Cass	19	0.9	Monroe	12	0.6
Charlevoix	6	0.3	Montcalm	31	1.5
Cheboygan	7	0.3	Montmorency	8	0.4
Chippewa	17	0.8	Muskegon	30	1.4
Clare	23	1.1	Newaygo	22	1.0
Clinton	11	0.5	Oakland	15	0.7
Crawford	1	0.0	Oceana	24	1.1
Delta	7	0.3	Ogemaw	10	0.5
Dickinson	10	0.5	Ontonagon	1	0.0
Eaton	57	2.7	Osceola	19	0.9
Emmet	17	0.8	Oscoda	2	0.1
Genesee	32	1.5	Otsego	3	0.1
Gladwin	21	1.0	Ottawa	47	2.2
Gogebic	0	–	Presque Isle	14	0.7
Grand Traverse	30	1.4	Roscommon	2	0.1
Gratiot	39	1.8	Saginaw	35	1.7
Hillsdale	50	2.4	Saint Clair	35	1.7
Houghton	4	0.2	Saint Joseph	30	1.4
Huron	176	8.3	Sanilac	65	3.1
Ingham	22	1.0	Schoolcraft	1	0.0
Ionia	27	1.3	Shiawassee	16	0.8
Iosco	12	0.6	Tuscola	120	5.7
Iron	2	0.1	Van Buren	79	3.7
Isabella	36	1.7	Washtenaw	55	2.6
Jackson	33	1.6	Wayne	13	0.6
Kalamazoo	50	2.4	Wexford	7	0.3
Kalkaska	11	0.5	Out of State	29	1.4
Kent	47	2.2	Unknown	83	3.9
Keweenaw	0	–	**Total**	2,111	100.0
Lake	5	0.2			
Lapeer	25	1.2			

Figure 5 **Geographic Distribution of Individuals with Work-Related Farm Injuries by County of Residence, Michigan 2017-2019**

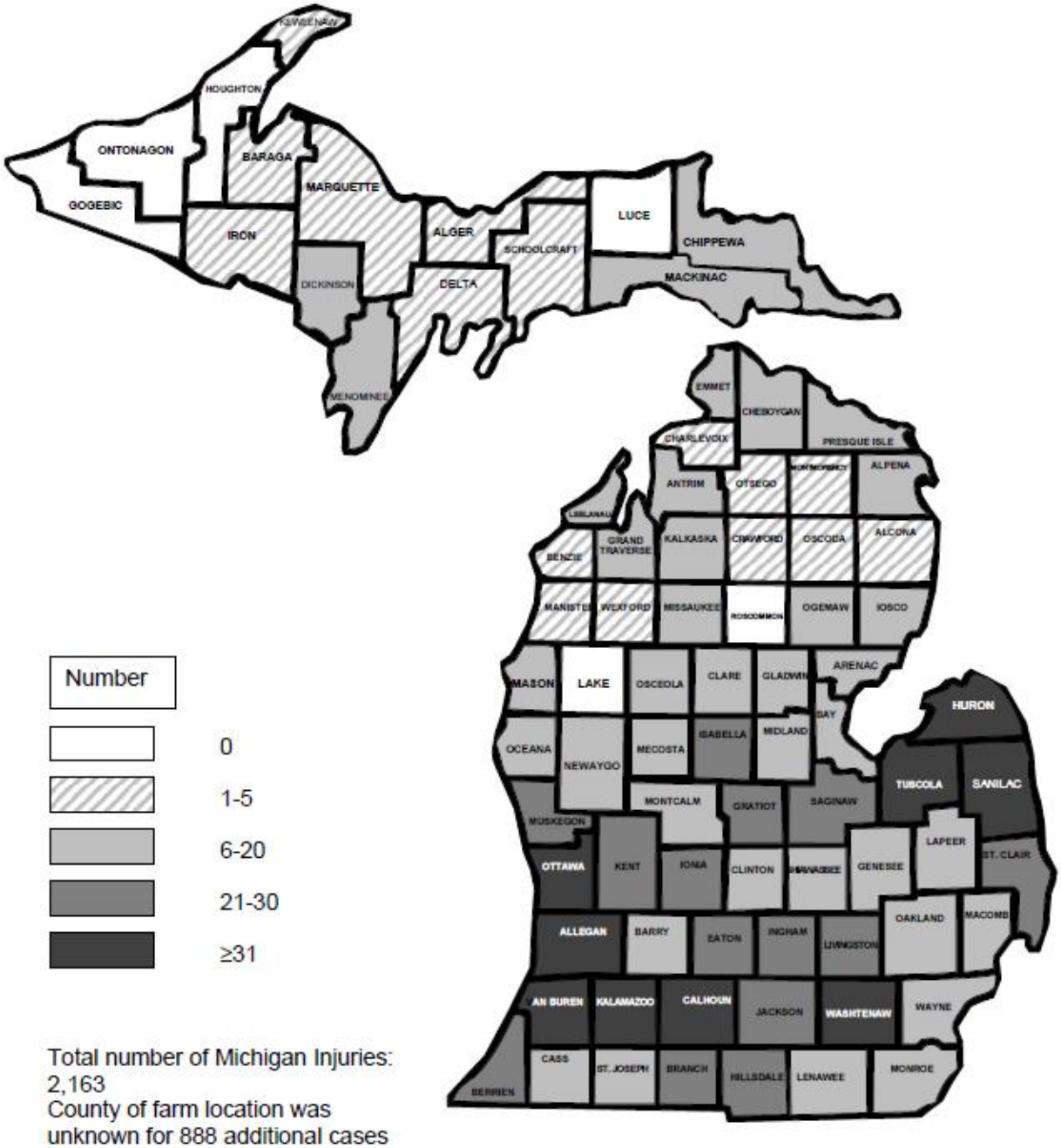


Total number of Michigan Residents: 1,999
County was unknown for 83 individuals and additional 29 individuals were out of state

Table 8. Work-Related Farm Injuries by County of Farm Location, Michigan 2017-2019

Michigan County	2017-2019		Michigan County	2017-2019	
	Number	Percent		Number	Percent
Alcona	1	0.05	Leelanau	11	0.5
Alger	2	0.1	Lenawee	13	0.6
Allegan	59	2.7	Livingston	23	1.1
Alpena	7	0.3	Luce	0	–
Antrim	12	0.6	Mackinac	8	0.4
Arenac	18	0.8	Macomb	17	0.8
Baraga	3	0.1	Manistee	2	0.1
Barry	19	0.9	Marquette	5	0.2
Bay	7	0.3	Mason	7	0.3
Benzie	1	0.05	Mecosta	10	0.5
Berrien	26	1.2	Menominee	6	0.3
Branch	23	1.1	Midland	13	0.6
Calhoun	47	2.2	Missaukee	9	0.4
Cass	14	0.6	Monroe	12	0.6
Charlevoix	5	0.2	Montcalm	13	0.6
Cheboygan	6	0.3	Montmorency	1	0.05
Chippewa	10	0.5	Muskegon	21	1.0
Clare	11	0.5	Newaygo	12	0.6
Clinton	7	0.3	Oakland	10	0.5
Crawford	1	0.05	Oceana	19	0.9
Delta	4	0.2	Ogemaw	6	0.3
Dickinson	7	0.3	Ontonagon	0	–
Eaton	30	1.4	Osceola	6	0.3
Emmet	13	0.6	Oscoda	2	0.1
Genesee	18	0.8	Otsego	1	0.05
Gladwin	13	0.6	Ottawa	36	1.7
Gogebic	0	–	Presque Isle	6	0.3
Grand Traverse	12	0.6	Roscommon	0	–
Gratiot	26	1.2	Saginaw	22	1.0
Hillsdale	30	1.4	Saint Clair	21	1.0
Houghton	0	–	Saint Joseph	20	0.9
Huron	104	4.8	Sanilac	40	1.8
Ingham	21	1.0	Schoolcraft	1	0.05
Ionia	22	1.0	Shiawassee	8	0.4
Iosco	12	0.6	Tuscola	64	3.0
Iron	1	0.05	Van Buren	56	2.6
Isabella	26	1.2	Washtenaw	38	1.8
Jackson	22	1.0	Wayne	7	0.3
Kalamazoo	34	1.6	Wexford	5	0.2
Kalkaska	10	0.5	Unknown	888	41.1
Kent	24	1.1			
Keweenaw	1	0.05	**Total**	2,163	100.0
Lake	0	–			
Lapeer	15	0.7			

Figure 6. **Geographic Distribution of Work-Related Farm Injuries by County of Farm Location, Michigan 2017-2017**



Total number of Michigan Injuries: 2,163
County of farm location was unknown for 888 additional cases

Farm Type

Information on farm type was available in the medical records for only 1,070 (49.5%) injuries. When farm type was recorded by a health care provider, dairy farms accounted for over a third (37.4%) of all injuries, followed by livestock farms with 25.3% of injuries (Table 9).

Table 9. Work-Related Farm Injuries by Farm Type, Michigan 2017-2019*

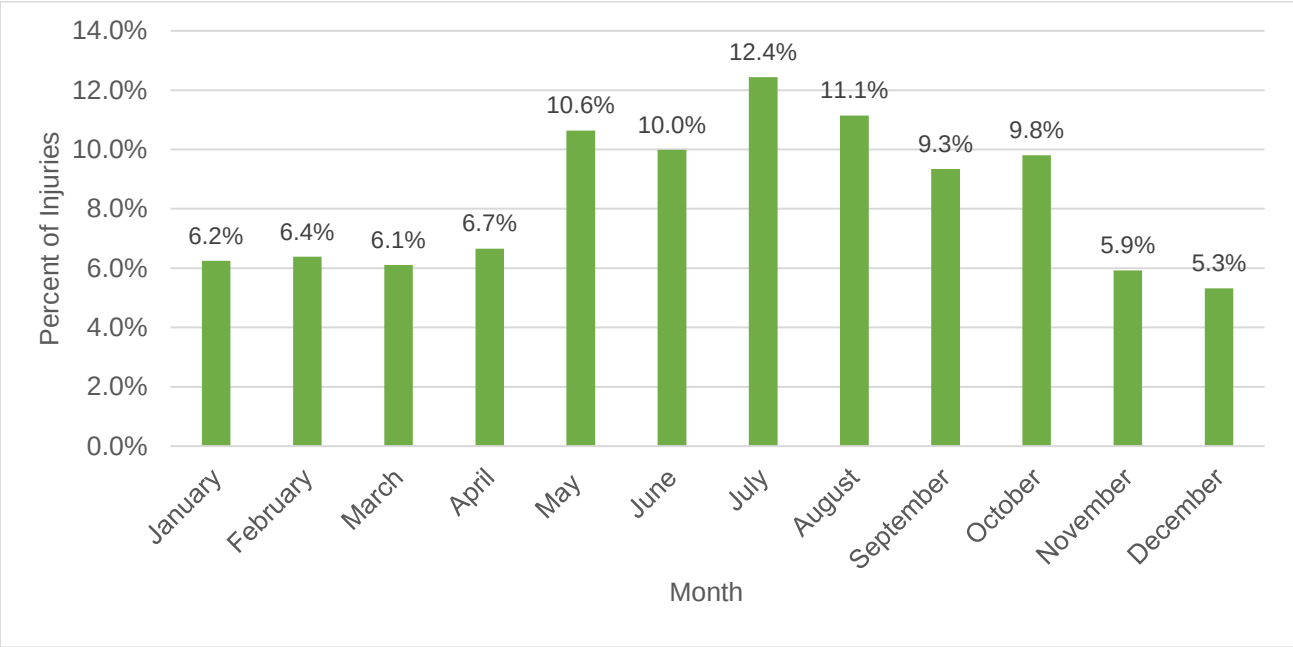
Farm Type	Number	Percent
Dairy	400	37.4
Livestock	271	25.3
Other	178	16.6
Fruit	74	6.9
Grain	55	5.1
Vegetable	55	5.1
Poultry	37	3.5%
Total	1,070	100.0%

*Information on farm type was available for 1,070 (49.5%) injuries.

Month of Medical Encounter and Farm Type by Seasonality

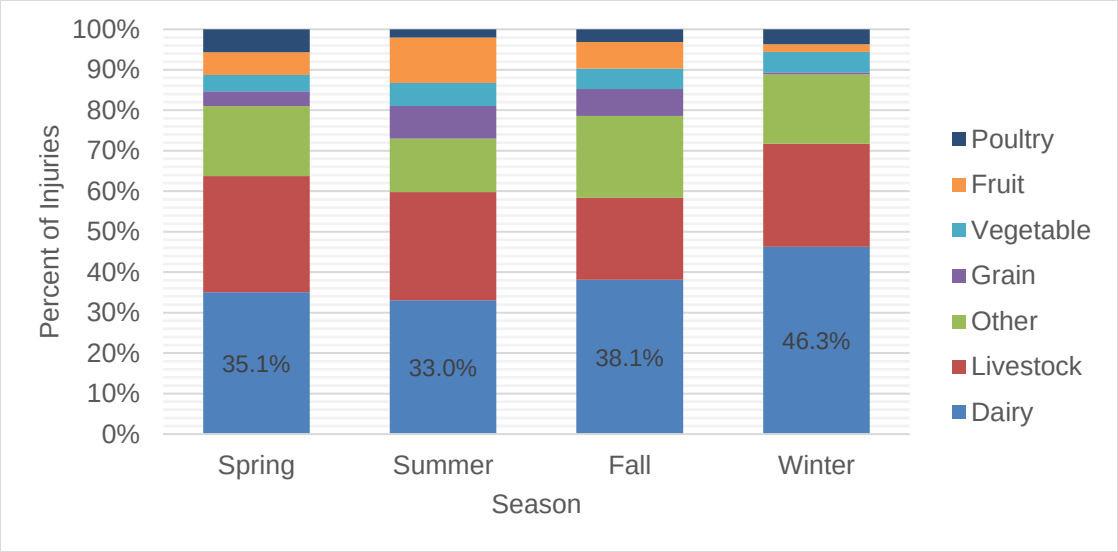
Information when an individual sought a medical care was available for all cases. More injuries occurred in summer months (33.6%), and July was the month with the highest number of injuries (269, 12.4%) (Figure 7).

Figure 7. Work-Related Farm Injuries by Month of Medical Encounter, Michigan 2017-2019



Work-related farm injuries at dairy farms accounted for 33.0-46.3% of all identified injuries throughout all the seasons (Figure 8). Second to injuries on dairy farms, injuries at livestock farms were the most common during spring and summer seasons, with 28.6% and 26.7% respectively. Grain farms had the most injuries in the summer (8.0%), poultry farms in the spring (5.6%). Both fruit and vegetable farms had the most injuries in the summer, with 11.2% and 5.7%, respectively (Figure 8).

Figure 8. Work-Related Farm Injuries by Farm Type and Seasonality, Michigan 2017-2019



Source of Payment

Commercial Insurance was the expected payer in 644 (38.0%) injuries, followed by Medicare or Medicaid in 580 (34.2%) injuries, Workers' Compensation in 362 (21.4%) injuries, self-pay in 103 (6.1%) of injuries and Other Government source of payment (Veterans' Administration) in 6 (0.3%) of injuries (Table 10). For 468 farm injuries, payment source could not be identified.

Table 10. Work-Related Farm Injuries by Expected Source of Payment, Michigan 2017-2019*

Expected Source of Payment	Number	Percent
Commercial	644	38.0
Medicare/Medicaid	580	34.2
Workers' Compensation	362	24.1
Self-Pay	103	6.1
Other Gov't	6	0.3
Total	1,695	100.0

Data Source: Michigan hospital/ED records

*Payment source was unknown for 468 (21.6%) injuries.

Industrial Hygiene Inspections

In 2017, Michigan OSHA inspected one workplace where a farm injury occurred. A male employee in his early forties sustained a crushing injury to his upper body, including rib contusions, as a result of a trench collapse, in which mud pushed the employee against a wall. The company was cited for one Serious violation of MIOSHA safety rules: “An excavation less than 5 feet in depth shall also be effectively protected when examination of the ground indicates hazardous earth movement may be expected”. The employee was exposed to the cave-in while installing an irrigation pipe in an approximately 3 feet deep excavation of wet, sandy soil. The company corrected the hazard during the inspection.

In 2020, Michigan OSHA inspected two workplaces where farm injuries occurred in 2019. In the first, a male employee in his late-twenties was hospitalized for twelve days, after dropping a 10,000-pound piece of metal farm equipment on his hand. This resulted in a crushing injury with exposed bone and muscle, as well as a complex fracture and wound infection. The company was cited for two Other-than-Serious violations: 1) “The company did not use MIOSHA 300A, 300, and 301 forms, or equivalent forms for the purpose of recording recordable injuries and illnesses.”; 2) “An employee inpatient hospitalization resulting from a work-related injury that occurred on July 11, 2019, was not reported to MIOSHA within 24 hours.” The violations were corrected during inspection.

In the second, a male employee in his late thirties was hospitalized for three days with a crushing injury, after a more than 1,000-pound trailer fell onto his foot (the employee was wearing a work boot). The employee was trapped for about five minutes until several men were able to lift the trailer off his foot. Injuries included obvious deformity to his foot, with lacerations, devascularized tissue, and severely displaced, fractured metatarsals, placing the employee at risk for amputation. The company was cited for one Other-than-Serious violation: “The employer did not report an injury that occurred to an employee on November 19, 2019 resulting in a three day hospitalization to the employee.” The violation was corrected during the inspection.

DISCUSSION

This is the second report on work-related farm injuries in Michigan. It covers three years, 2017, 2018 and 2019. Michigan surveillance identified 2,163 work-related farm injuries in 2,111 individuals for the three years combined. The number and rate of injuries per 100 workers was 812 and 0.38 in 2017, 730 and 0.34 in 2018 and 621 and 0.29 in 2019.

By comparison, the employer-based system from BLS estimated 3,100 farm injuries for Michigan with 1,300 injuries and a rate of 6.6 per 100 full-time equivalents in 2017, 1,000 injuries and a rate of 4.7 per 100 full-time equivalents and 800 injuries and a rate of 4.0 per 100 full-time equivalents in 2019 (Table 11).[5] The BLS rates are higher than the Michigan surveillance system's rates because BLS reported more injuries and the denominator used to calculate the rates did not include farm owners/operators, family members and farm workers who work on farms with less than 11 employees, all of which were included in Michigan surveillance. The inclusion of producers and family members and all hired hands regardless of the number of employees on a farm in the Michigan surveillance system increased the denominator we used in calculating the rates by at least 135,000 individuals. The occurrence of a larger number of reported injuries in the BLS system could be because hired hands and migrant farmers are receiving medical care from migrant health clinics and other outpatient facilities that do not report to the Michigan surveillance system. Another possibility is that the BLS count is a statistical extrapolation and not a census and the extrapolation based on a small number of reporting farms overestimated the count.

Table 11. Number and Incidence Rates of Work-Related Farm Injuries by Industry and Case Types, Michigan 2017-2019*

Industry	2017				2018				2019			
	Total Recordable Cases		Cases with Days Away from Work, Job Transfer, or Restriction		Total Recordable Cases		Cases with Days Away from Work, Job Transfer, or Restriction		Total Recordable Cases		Cases with Days Away from Work, Job Transfer, or Restriction	
	Number	Rate[3]	Number	Rate[3]	Number	Rate[3]	Number	Rate[3]	Number	Rate[3]	Number	Rate[3]
Agriculture[1,2]	1,300	6.6	500	2.9	1,000	4.7	600	3.0	800	4.0	400	2.3
Crop Production[2]	600	5.4	300	3.1	600	4.6	300	2.7	400	3.6	200	2.2
Animal Production and Aquaculture[2]	700	8.2	200	2.8	400	5.1	300	3.4	400	4.6	200	2.5

*U.S. Bureau of Labor Statistics

[1]Excludes Forestry, Fishing and Hunting

[2]Excludes farms with fewer than 11 employees

[3]The incidence rates represent the number of injuries and illnesses per 100 full-time workers and were calculated as: (N/EH) x 200,000 where N = number of injuries and illnesses; EH = total hours worked by all employees during the calendar year; 200,000 = base for 100 equivalent full-time workers (working 40 hours per week, 50 weeks per year)

BLS estimates of Michigan non-fatal work-related farm injuries involving days away from work with or without job transfer or restriction for 2017, 2018 and 2019 were analyzed by age groups, location and type of injury.[7] Farm injuries of upper extremities were the most common location both in the BLS data set (34.7%) and in the Michigan surveillance system (37.4%). Farm injuries among 20-24 year old's were the most common age group in the BLS data set (25.5%), while 25-34 year old's were the most common age group in the Michigan surveillance system (17.4%). Sprains, strains and tears were the most common type of injury in the BLS data set (20.4%), while contusions and bruises were the most common type of injury in the Michigan surveillance system (19.1%).

Workers' Compensation was identified as the payer for only 21.4% of the work-related farm injuries treated at Michigan hospital and emergency department in 2017 through 2019. The data from the Michigan Hospital Administrative Database, where workers' compensation was the primary expected payer and place of occurrence was farm, identified a smaller number of farm work-related injuries in 2017, 2018 and 2019 than the Michigan's surveillance system, with 202, 162 and 137 cases, respectively.

The Workers' Compensation database identified only 130 (6.0%) of the 2,163 work-related farm injuries. The possible explanations for the Workers' Compensation difference include: 1) The WDCA data set only included farm injuries that caused seven or more consecutive days away from work, presumably the most severe cases; 2) Agricultural employers if they employ less than three employees do not have to carry workers' compensation coverage; 3) WDCA excluded the self-employed (Michigan's surveillance identified 864 owner/operators) and family members (Michigan's surveillance identified 163 family members); 4) It is possible that some companies are handling farm injuries unofficially and not reporting them to Workers' Compensation insurance companies or the WDCA.

There were an additional 33 agricultural fatalities (9 in 2017, 6 in 2018 and 18 in 2019) identified by the Michigan Fatality Assessment and Control Evaluation (MIFACE) Program.[8]

Surveillance of work-related farm 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 reliable count of the total number of work-related farm injuries requiring hospitalization or an emergency department visit but the reports can also be used to identify specific farms to perform follow back investigations. The investigations completed at three farm identified major correctible problems.

Outreach activity included providing information on the Michigan AgrAbility Program[4] to farm operators and workers whose injury suggested they may have ongoing serious impairment. We have mailed one hundred twenty-one letters and AgrAbility brochures to individuals with farm injuries.

We have developed educational materials for distribution to farm employers and employees where we see patterns in causes for the farm injuries; safe animal handling; farm-related machine entanglements; safe use of tractors; slippery clutch pedal; farmers and trees; tractors with ROPS (Rollover Protection Structure); safely starting a tractor; and using a controlled atmosphere (CA) apple storage room.[9] Development and distribution of this information will allow employers to work with employees to implement effective prevention strategies including maintenance of equipment and safer work practices to prevent future farm injuries.

REFERENCES

1. Michigan Administrative Code Rule 325.301-306, available at: http://dmbinternet.state.mi.us/DMB/DTMBORR/AdminCode.aspx?AdminCode=Department&Dpt=HS&Level_1=Population+Health+and+Community+Services

2. United States Department of Agriculture. 2017 Census of Agriculture for Michigan, available at: https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/Michigan/

3. International Classification of Diseases, Tenth Revision, Clinical Modification available at: https://www.cdc.gov/nchs/icd/icd10cm.htm# FY 2017 release of ICD-10-CM

4. Michigan AgrAbility Program. Website: www.michiganagrability.org

5. United States Department of Labor, Bureau of Labor Statistics. Nonfatal occupational injuries and illnesses data by industry (SOII). 2017, 2018 and 2019 Michigan, available at: https://www.bls.gov/iif/oshstate.htm#MI

6. United States Census Bureau. North American Industry Classification System available at: https://www.census.gov/naics/

7. United States Department of Labor, Bureau of Labor Statistics' State Occupational Injuries and Illnesses and Fatalities Injuries Profiles, Michigan 2017, 2018 and 2019. Data obtained by navigating through screens starting at the following website: https://data.bls.gov/gqt/InitialPage

8. Michigan Fatality Assessment and Control Evaluation available at: http://oem.msu.edu/MiFACE_Program.aspx

9. Work-Related Hazard Alerts: Michigan State University. Department of Medicine. Occupational and Environmental Medicine available at https://oem.msu.edu/index.php/work-related-injuries/miface-hazard-alerts