Work-Related Farm Injuries in Michigan: Third Report (January 2020 – December 2021)

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 25, 2023

Work-Related Farm Injuries in Michigan:

Third Report

(January 2020 – December 2021)

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

Michigan State University's Occupational and Environmental Medicine Division compiles data on work-related farm injuries in the state of Michigan. This is the third report on occupational farm-related injuries in Michigan; it covers two years, 2020 and 2021. These are the key findings:

- Work-related farm injuries were identified through hospital medical records
  - In 2020, there were 439 work-related farm injuries in 437 individuals, rate was 206.3/100,000.
  - In 2021, there were 387 work-related farm injuries in 383 individuals, was 181.9/100,000.
  - Over the two years combined, there were 826 work-related farm injury incidents in 810 individuals; six individuals each sustained two farm injuries in the same calendar year, and ten individuals sustained two farm injuries in two separate calendar years.
  - **Since 2015, the number of work-related farm injuries have decreased 43% and the rate of work-related farm injuries has decreased 28%.**
- The most common type of medical encounter was an emergency department visit (667; 80.8%).
- Seventy-seven percent of all farm-related injuries were among men; 90.6% were among Caucasians.
- The most common part of the body injured was an upper limb (337; 41.1%), followed by a lower limb (224; 27.3%).
- The most common types of injury were fractures (206; 25.5%) and contusions (144; 17.8%) which together accounted for 43% of all farm injuries.
- Injuries caused by cows were the predominant cause of work-related farm injuries and accounted for almost a third (256; 31.8%) of all injuries. Dairy farms accounted for 42.6% of all the injuries for which the farm type was recorded by a health care provider.
- Owners/operators accounted for 50.8% and hired hand for 35.9% of all individuals injured while working on a farm.
- Commercial insurance was the expected payer for 297 (47.0%) of the injuries, followed by Medicare/Medicaid in 172 (27.2%) of the injuries.

BACKGROUND

Report purpose: This is the third report on work-related farm injuries in Michigan. The report is based on data for the years 2020 and 2021.

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. 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]

The U.S. Department of Agriculture (USDA) conducts a Census of Agriculture every five years (the 2022 results will be released in 2024). The most recent census from 2017 reported 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

(c) 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 44 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 MORC 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 was hospitalized, treated in an emergency department or as an outpatient at a hospital in 2020 or 2021; 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.

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

[*]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).

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, which 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 2020 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. BLS estimate for 2021 was not available at the time of completion of this report.

RESULTS

In 2020, there were 439 work-related farm injuries in 337 individuals; two individuals had two farm injuries. The rate was 206.3/100,000. In 2021, there were 387 work-related farm injuries in 383 individuals; four individuals each had two farm injuries. The rate was 181.9/100,000 workers. Six individuals sustained two farm injuries in the same calendar year, and 10 individuals sustained two farm injuries in two separate calendar years (Table 2).

2020-2021 Combined: There were 826 work-related farm injuries in 810 individuals because six individuals each sustained two farm injuries in the same calendar year, and ten individuals had a farm injury in two separate calendar years.

Table 2. Work-Related Farm Injuries by the Number of Individuals, Injuries and Injury Rates, Michigan 2020-2021

Year	Number of Individuals	Number of Injuries	Injury Rate[1]
2020	437	439	206.3
2021	383	387	181.9
2020-2021	810[2]	826	194.1

[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 two-year-period is 810; sixteen individuals sustained two separate injuries during the two-year-period.

Type of Medical Encounter

An emergency department visit was the most common type of medical encounter: 667 (80.8%) injuries (Table 3). Thirteen percent of individuals were hospitalized due to the farm injury they sustained, and 5.9% were seen at a hospital based clinic. The remaining 0.7% of work-related farm injuries received another type of medical care such as PCC consultation.

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

Medical Encounter Type	Number	Percent
Emergency Department	667	80.8
In-patient Hospitalization	104	12.6
Hospital Outpatient	49	5.9
Other*	6	0.7
Total	826	100.0

*Other includes PCC consultations and other unspecified medical care visits.

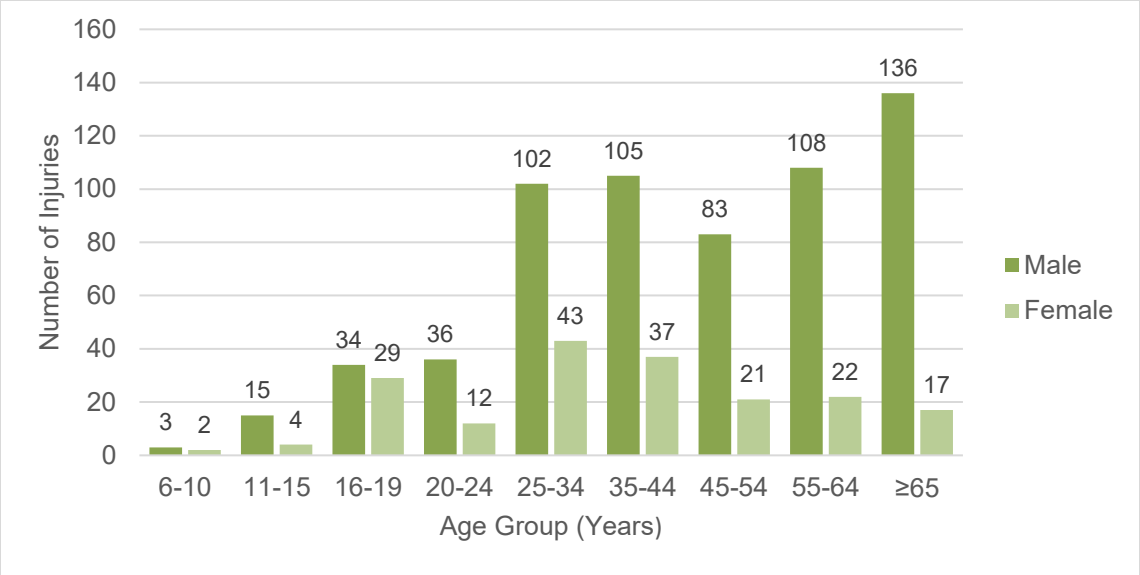
Characteristics of Injured Farm Operators, Working Family Members, Hired Hands and Migrant Workers

Age and Gender

The age of injured farm operators and workers varied from 6 to 92 years; age was not provided for one worker. The average age was 45.1 and the median age was 43.0. Six hundred and twenty-three (76.9%) 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 55-64 age groups, 136 and 108, respectively. For females, the age groups with the highest number of farm injuries were 25-34 and 35-44 with 43 and 37 injuries, respectively.

There were five children 10 years and under injured while performing chores on a farm. The injuries of the five children were: having a finger fractured by a cow that stepped onto it; getting concrete dust in their eye while working in a barn; being pinned against a barn wall by a cow; being struck in the face by a lead pipe; fainting and hitting their head while assisting during farrowing.

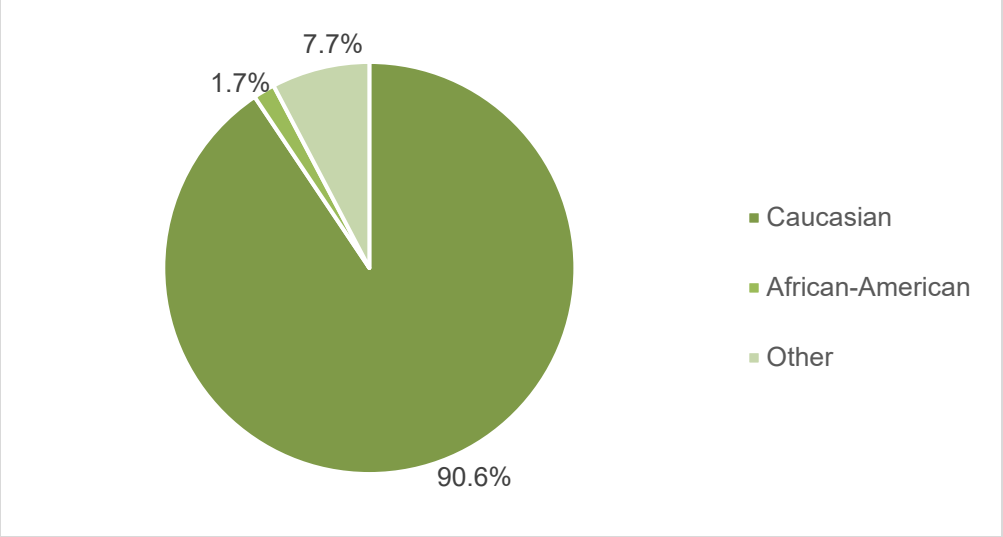
Figure 1. Work-Related Farm Injuries by Age Groups and Gender, Michigan 2020-2021



Race and Ethnicity

The race of farm operators and workers with work-related farm injuries was available for 416 (51.4%) of the individuals; 377 (90.6%) were Caucasian, seven (1.7%) were African American, and 32 (7.7%) were “Other” (Figure 2).

Figure 2. Race Distribution of Work-Related Farm Injuries, Michigan 2020-2021*



*Information on race was available for 416 (51.4%) individuals.

Information on ethnicity was provided for 330 (40.7%) individuals. Of the 330 individuals, 68 individuals (20.6%) were of Hispanic origin. Hispanic workers were more likely to be a hired hand (88.2%) than non-Hispanic workers who were more likely to be owner/operators (66.3%) (Table 4). Most farm injuries in both Hispanic workers and non-Hispanic workers occurred on dairy farms with 18 (45.0%) and 28 (40.6%) cases, respectively. Injured Hispanic workers were more likely to have worked on fruit and vegetable farms (35.0%) than non-Hispanic workers (11.5%) 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 2020-2021

Occupation Type[1]	Hispanic Workers		Non-Hispanic Workers	
	Number	Percent	Number	Percent
Hired hand	30	88.2	18	17.3
Migrant worker	2	5.9	0	–
Owner/operator	1	2.9	69	66.3
Family member	1[3]	2.9	17[3]	16.3
Total	34	100.0	104	100.0
Farm Type[2]	**Hispanic Workers**		**Non-Hispanic Workers**	
	Number	Percent	Number	Percent
Dairy	18	45.0	28	40.6
Fruit	12	30.0	3	4.3
Livestock	4	10.0	18	26.1
Grain	2	5.0	12	17.4
Vegetable	2	5.0	5	7.2
Other	2	5.0	3	4.3
Total	40	100.0	69	100.0

[1]Information on both ethnicity and occupation type was available for 138 (41.8%) individuals.

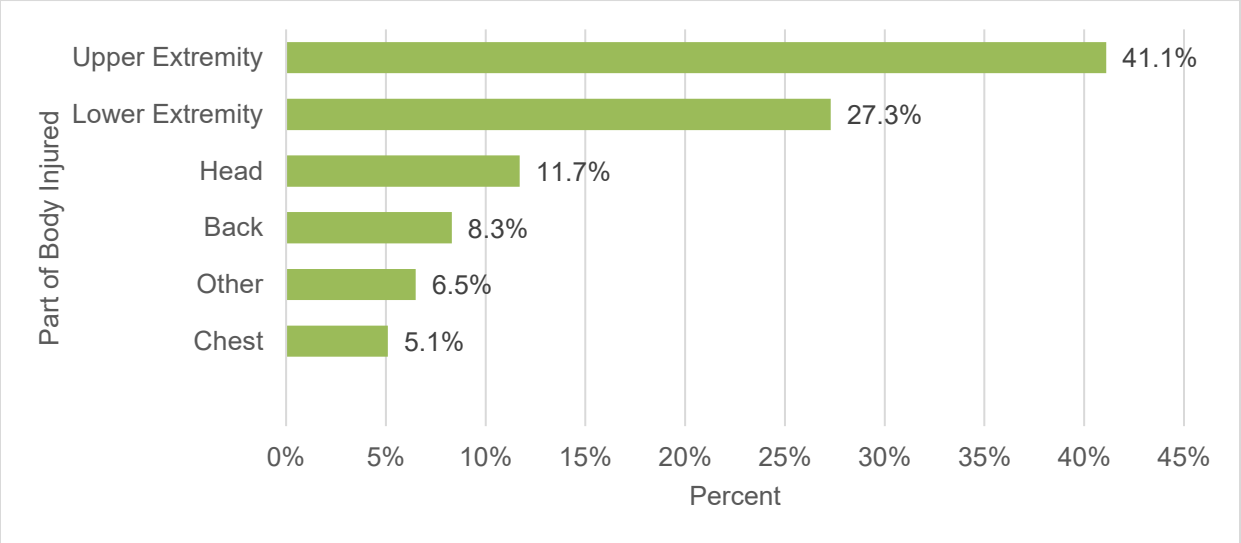
[2]Information on both ethnicity and farm type was available for 109 (33.0%) individuals.

[3]Includes two 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 (41.1%), followed by injuries of lower limbs (27.3%).

Figure 3. Work-Related Farm Injuries by Part of Body Injured, Michigan 2020-2021*



*Information on part of body injured was available for 820 (99.3%) of injuries. Percentages are based on the primary diagnosis of the injury.

Injury Source

For 805 (97.5%) injuries, the source of the injury was provided in the medical records (Table 5). Injuries caused by cattle were the most common and accounted for almost a third of all injuries (256, 31.8%). 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 87 (10.8%) and 86 (10.7%) injuries, respectively (Table 6). Category “Other” contained different types of injury sources that did not fall into the nine specific categories. Examples of injuries categorized under “Other” category include being struck by a log that flew off a log splitter, being hit by a gate in the chest while running from an animal that was charging, having a hand burned by bales on fire, having a box of pitchforks fall on a foot, being struck by a tree branch.

Table 5. Work-Related Farm Injuries by Injury Source, Michigan 2020-2021*

Injury Source	Number	Percent
Cattle	256	31.8
Non Tractor Machine	87	10.8
Tractor	86	10.7
Fall from Height	70	8.7
Tool	58	7.2
Fall at Ground Level	52	6.5
Livestock	37	4.6
Chemical	32	4.0
Horse	15	1.9
Other	112	13.9
Total	805	100.0

*Information on injury source was available for 805 (97.5%) injuries.

Nature of Injury

The most common type of injury was a fracture, in 25.5% of cases, followed by a contusion/bruise, in 17.8% of cases (Table 6). These two natures of injury accounted for 43.3% of all types of injuries identified.

Table 6. Work-Related Farm Injuries by Nature of Injury, Michigan 2020-2021*

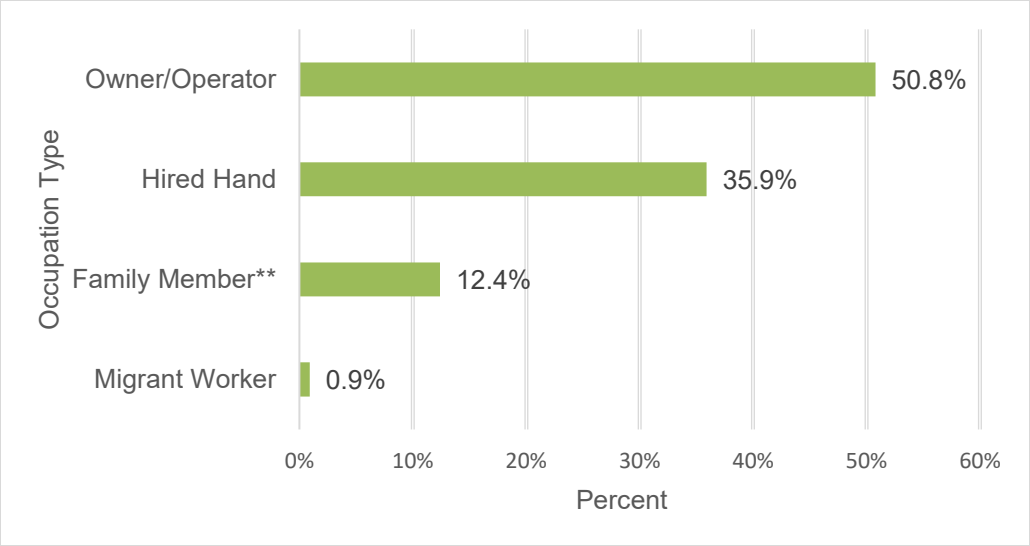
Nature of Injury	Number	Percent
Fracture	206	25.5
Contusion/Bruise	144	17.8
Laceration/Cut/Puncture	114	14.1
Other	102	12.6
Crushing Injury	57	7.0
Sprain/Strain	56	6.9
Burn	39	4.8
Head Injury (no fractures)	26	3.2
Amputation	19	1.2
Abrasion	17	2.1
Dislocation	13	1.6
Animal Bite/Sting	9	1.1
Concussion	7	0.9
Total	809	100.0

*Information on nature of injury was available for 809 (97.9%) injuries. Numbers were based on the primary diagnosis.

Occupation Type

The occupation was specified in 39.9% of the medical records. Owner/operators accounted for half (50.8%) of all the individuals injured, followed by hired farm labor (35.9%), family members, including two non-paid friends and neighbors who assisted (12.4%) and migrant workers (0.9%) (Figure 4).

Figure 4. Work-Related Farm Injuries by Occupation Type, Michigan 2020-2021*



*Occupation type was specified for 323 (39.9%) individuals.
**Includes two non-paid friends and neighbors who assisted.

County of Residence and County of Farm

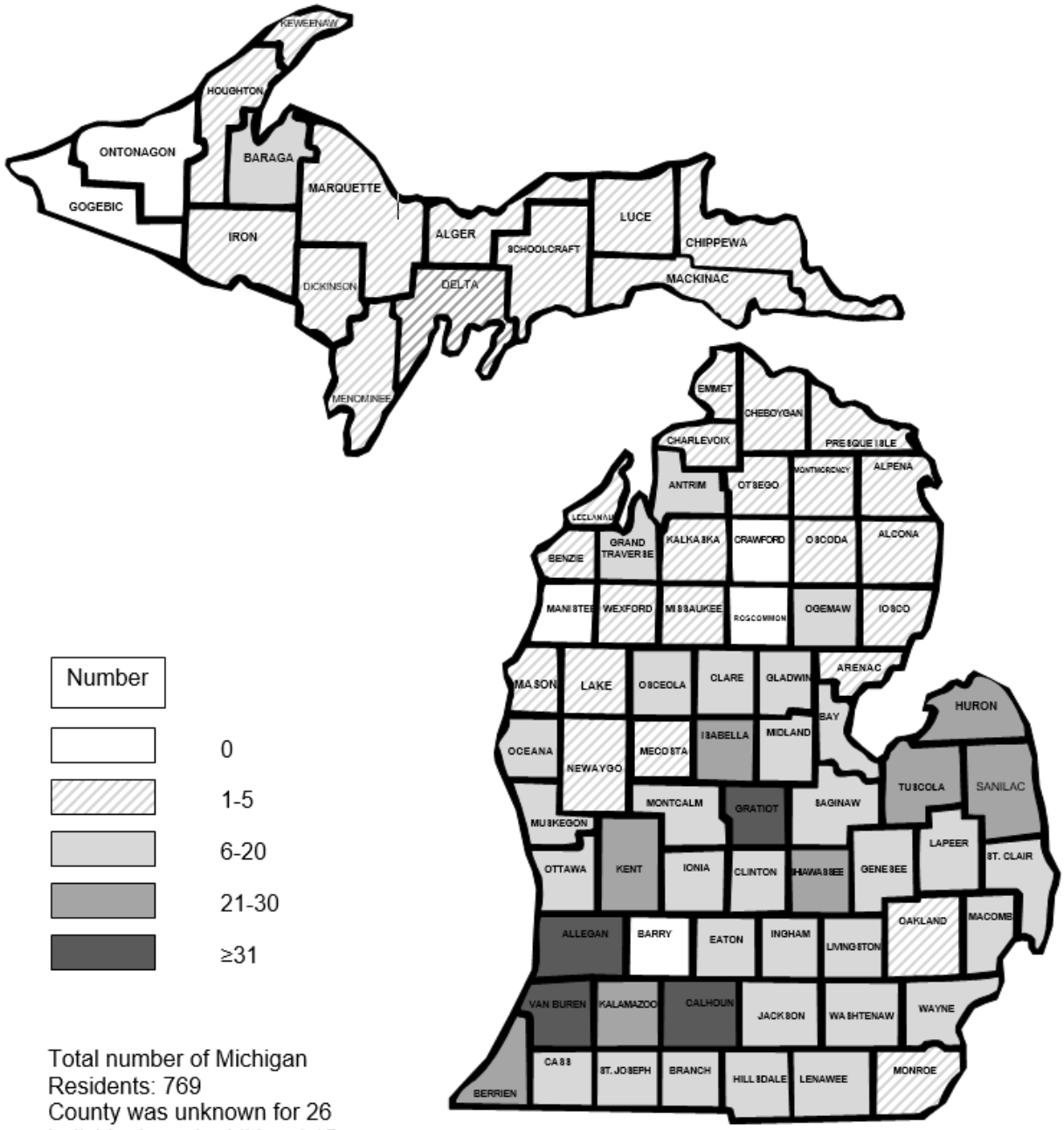
The Michigan county of residence was known for 769 of the injured; another 15 were out-of-state workers, and 26 residents of Michigan the county was unknown. It should be noted that the county of residence would not necessarily be the same county where the individual was injured and where the farm was located. Calhoun County had the highest number of residents with a work-related farming injury with 46 (5.7%) cases, followed by Van Buren County with 37 (4.6%) cases, and then Gratiot County with 36 (4.4%) cases (Table 7 and Figure 5).

Information on the county where the farm was located and where the injury occurred was specified for only 156 (18.9%) injuries (Table 8 and Figure 6). Huron County had the highest number of farm work-related injuries with 16 (1.9%) cases, followed by Tuscola and Sanilac Counties both with 11 (1.3%) cases.

Table 7. Number and Percent of Individuals with Work-Related Farm Injuries by County of Residence, Michigan 2020-2021

Michigan County	2020-2021		Michigan County	2020-2021	
	Number	Percent		Number	Percent
Alcona	3	0.4	Leelanau	4	0.5
Alger	1	0.1	Lenawee	6	0.7
Allegan	32	4.0	Livingston	9	1.1
Alpena	5	0.6	Luce	2	0.2
Antrim	6	0.7	Mackinac	3	0.4
Arenac	4	0.5	Macomb	12	1.5
Baraga	6	0.7	Manistee	0	–
Barry	0	–	Marquette	3	0.4
Bay	10	1.2	Mason	4	0.5
Benzie	3	0.4	Mecosta	3	0.4
Berrien	27	3.3	Menominee	1	0.1
Branch	6	0.7	Midland	8	1.0
Calhoun	46	5.7	Missaukee	4	0.5
Cass	14	1.7	Monroe	2	0.2
Charlevoix	2	0.2	Montcalm	8	1.0
Cheboygan	2	0.2	Montmorency	5	0.6
Chippewa	2	0.2	Muskegon	10	1.2
Clare	9	1.1	Newaygo	2	0.2
Clinton	11	1.4	Oakland	2	0.2
Crawford	0	–	Oceana	7	0.9
Delta	2	0.2	Ogemaw	12	1.5
Dickinson	3	0.4	Ontonagon	0	–
Eaton	9	1.1	Osceola	6	0.7
Emmet	5	0.6	Oscoda	1	0.1
Genesee	12	1.5	Otsego	4	0.5
Gladwin	10	1.2	Ottawa	13	1.6
Gogebic	0	–	Presque Isle	4	0.5
Grand Traverse	11	1.4	Roscommon	0	–
Gratiot	36	4.4	Saginaw	18	2.2
Hillsdale	6	0.7	Saint Clair	15	1.9
Houghton	3	0.4	Saint Joseph	16	2.0
Huron	33	4.1	Sanilac	30	3.7
Ingham	11	1.4	Schoolcraft	1	0.1
Ionia	7	0.9	Shiawassee	24	3.0
Iosco	5	0.6	Tuscola	24	3.0
Iron	2	0.2	Van Buren	37	4.6
Isabella	23	2.8	Washtenaw	12	1.5
Jackson	14	1.7	Wayne	8	1.0
Kalamazoo	24	3.0	Wexford	2	0.2
Kalkaska	2	0.2	Out of State	15	1.9
Kent	22	2.7	Unknown	26	3.2
Keweenaw	2	0.2	**Total**	810	100.0
Lake	1	0.1			
Lapeer	15	1.9			

Figure 5 **Geographic Distribution of Individuals with Work-Related Farm Injuries by County of Residence, Michigan 2020-2021**

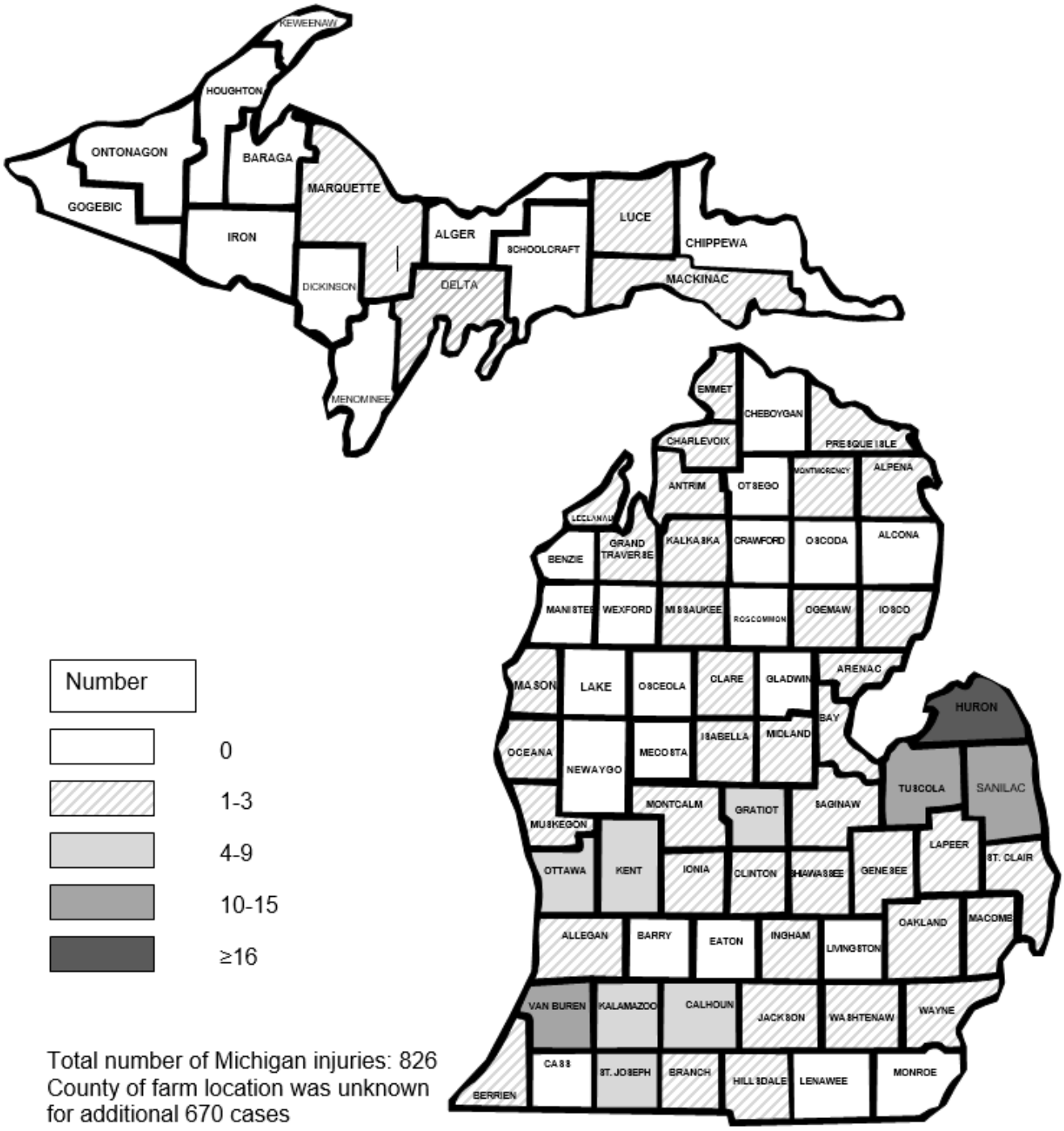


Total number of Michigan Residents: 769
County was unknown for 26 individuals and additional 15 were out of state

Table 8. Number and Percent of Individuals with Work-Related Farm Injuries by County of Farm, Michigan 2020-2021

Michigan County	2020-2021		Michigan County	2020-2021	
	Number	Percent		Number	Percent
Alcona	0	–	Leelanau	2	0.2
Alger	0	–	Lenawee	0	–
Allegan	3	0.4	Livingston	0	–
Alpena	1	0.1	Luce	2	0.2
Antrim	1	0.1	Mackinac	2	0.2
Arenac	1	0.1	Macomb	1	0.1
Baraga	0	–	Manistee	0	–
Barry	0	–	Marquette	1	0.1
Bay	2	0.2	Mason	2	0.2
Benzie	0	–	Mecosta	0	–
Berrien	3	0.4	Menominee	0	–
Branch	1	0.1	Midland	2	0.2
Calhoun	8	1.0	Missaukee	2	0.2
Cass	0	–	Monroe	0	–
Charlevoix	1	0.1	Montcalm	2	0.2
Cheboygan	0	–	Montmorency	1	0.1
Chippewa	0	–	Muskegon	2	0.2
Clare	2	0.2	Newaygo	0	–
Clinton	2	0.2	Oakland	2	0.2
Crawford	0	–	Oceana	3	0.4
Delta	1	0.1	Ogemaw	2	0.2
Dickinson	0	–	Ontonagon	0	–
Eaton	0	–	Osceola	0	–
Emmet	1	0.1	Oscoda	0	–
Genesee	3	0.4	Otsego	0	–
Gladwin	0	–	Ottawa	6	0.7
Gogebic	0	–	Presque Isle	1	0.1
Grand Traverse	3	0.4	Roscommon	0	–
Gratiot	4	0.5	Saginaw	3	0.4
Hillsdale	1	0.1	Saint Clair	1	0.1
Houghton	0	–	Saint Joseph	4	0.5
Huron	16	1.9	Sanilac	11	1.3
Ingham	1	0.1	Schoolcraft	0	–
Ionia	2	0.2	Shiawassee	2	0.2
Iosco	1	0.1	Tuscola	11	1.3
Iron	0	–	Van Buren	10	1.2
Isabella	1	0.1	Washtenaw	2	0.2
Jackson	2	0.2	Wayne	1	0.1
Kalamazoo	4	0.5	Wexford	0	–
Kalkaska	1	0.1	Unknown	670	81.1
Kent	5	0.6			
Keweenaw	0	–	**Total**	826	100.0
Lake	0	–			
Lapeer	2	0.2			

Figure 6 **Geographic Distribution of Work-Related Farm Injuries by County of Farm Location, Michigan 2020-2021**



Total number of Michigan injuries: 826
County of farm location was unknown for additional 670 cases

Farm Type

Information on farm type was available in the medical records for only 230 (27.8%) injuries. When farm type was recorded by a health care provider, dairy farms accounted for over a third (42.6%) of all injuries, followed by livestock farms with 16.1% of injuries (Table 9).

Table 9. Work-Related Farm Injuries by Farm Type, Michigan 2020-2021*

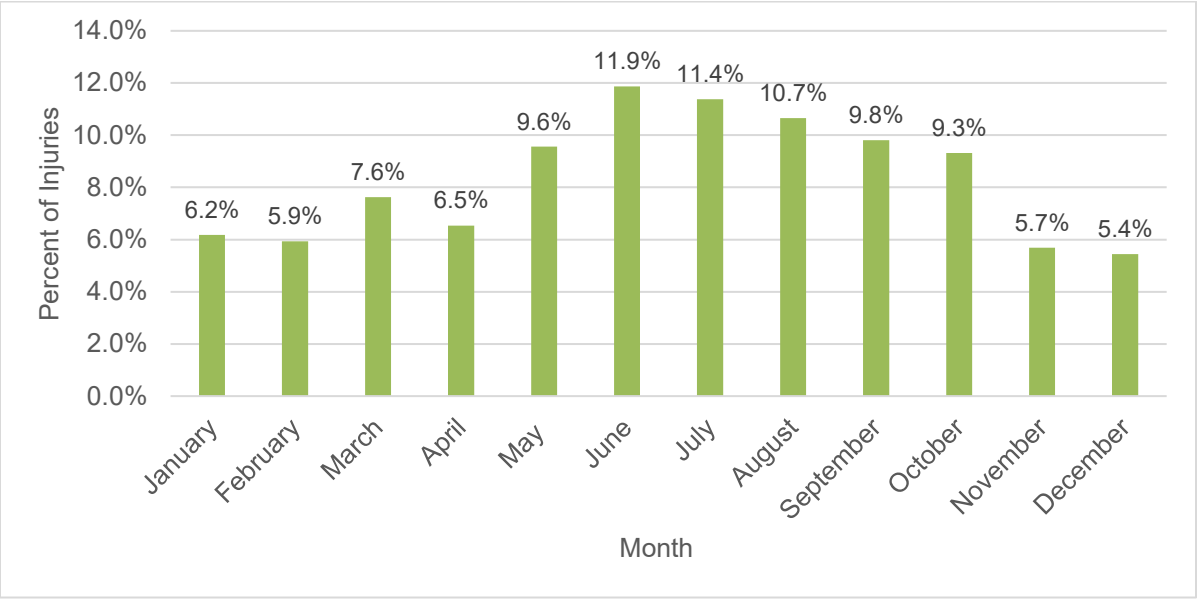
Farm Type	Number	Percent
Dairy	98	42.6
Livestock	37	16.1
Fruit	29	12.6
Grain	29	12.6
Vegetable	20	8.7
Other	13	5.7
Poultry	4	1.7
Total	230	100.0

*Information on farm type was available for 230 (27.8%) cases

Month of Medical Encounter and Farm Type by Seasonality

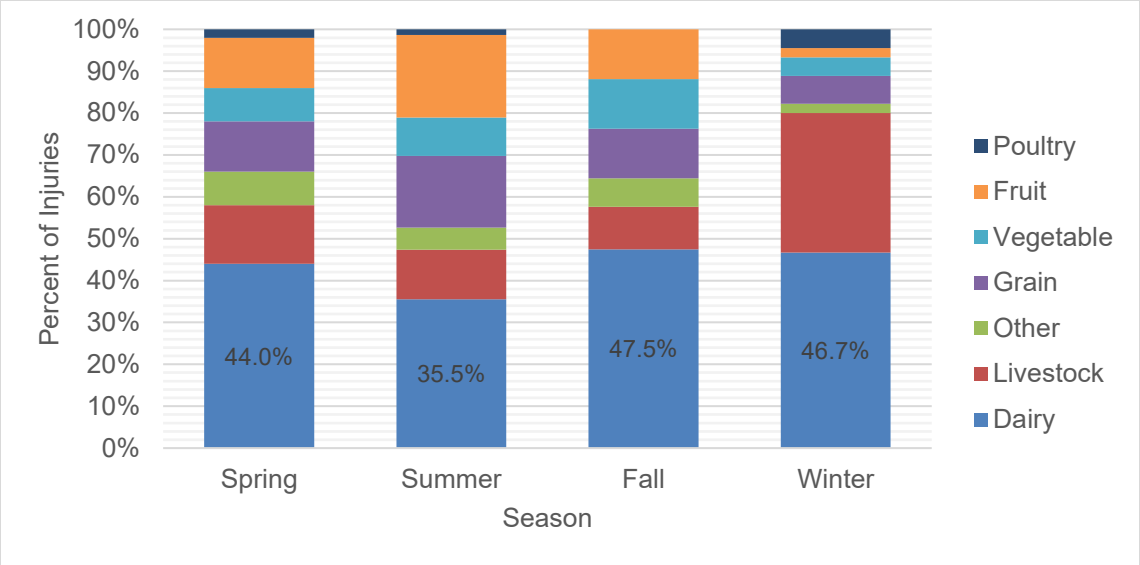
Information when an individual sought medical care was available for all cases. More injuries occurred in the summer months (34.0%); June and July were the months with the highest number of injuries (Figure 7).

Figure 7. Work-Related Farm Injuries by Month of Medical Encounter, Michigan 2020-2021



Work-related farm injuries at dairy farms accounted for 35.5-46.7% 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 winter and spring seasons, with 33.3% and 14.0% respectively. Grain farms had the most injuries in the summer (17.1%), poultry farms in the winter (4.4%). Fruit farms had the most injuries in the summer, with 19.7% and vegetable farms had the most injuries in fall, with 11.9% (Figure 8).

Figure 8. Work-Related Farm Injuries by Farm Type and Seasonality, Michigan 2020-2021



Source of Payment

Commercial Insurance was the expected payer for 297 (47.0%) of the injuries, followed by Medicare or Medicaid for 172 (27.2%) of the injuries, Workers' Compensation for 137 (21.7%) of the injuries, self-pay for 23 (3.6%) of the injuries and Other Government source of payment (Veterans' Administration) for 3 (0.5%) of the injuries (Table 10). For 194 farm injuries, payment source could not be identified.

Table 10. Work-Related Farm Injuries by Expected Source of Payment, Michigan 2020-2021*

Expected Source of Payment	Number	Percent
Commercial	297	47.0
Medicare/Medicaid	172	27.2
Workers' Compensation	137	21.7
Self-Pay	23	3.6
Other Gov't	3	0.5
Total	632	100.0

Data Source: Michigan hospital/ED records

*Payment source was unknown for 194 (23.5%) injuries.

Industrial Hygiene Inspections

In 2021, Michigan OSHA inspected one workplace where a farm injury occurred. A male employee in his teens sustained a fracture of his pelvic bone and internal injuries to his abdomen when he was riding on a tractor as a passenger and fell off and the back wheel of the tractor ran over him. The company, which owned the farm was cited for one serious violation of the MIOSHA standard: “Every employee who operates an agricultural tractor shall be informed of the operating practices contained in Appendix A of this part and any other practices dictated by the work environment. Such information shall be provided at the time of initial assignment and at least annually thereafter.” The tractor operator was not trained to not allow other employees to ride on the step of the John Deere 25/55 Open Cab Agricultural Tractor. The company corrected the hazard during the inspection.

DISCUSSION

This is the third report on work-related farm injuries in Michigan. It covers two years, 2020 and 2021. Michigan surveillance identified 826 work-related farm injuries in 810 individuals for the two years combined. The number and rate of injuries per 100 workers was 439 and 0.21 in 2020 and 387 and 0.18 in 2021. The number of farm-related injuries in 2020 and 2021 are less than in previous years; 677 in 2015, 882 in 2016, 812 in 2017, 730 in 2018, and 621 in 2019. There has not been a change in the surveillance system during this time and ideally the downward trend reflects an actual decrease in farm-related injuries. The downward trend increased in 2020 and 2021. It is possible that COVID-19, and the associated regulatory actions contributed to the decrease in 2020 and 2021. However, preliminary data from 2022 shows a similar number of farm-related injuries as in 2020 and 2021.

There were an additional 45 agricultural fatalities (26 in 2020 and 19 in 2021) identified by the Michigan Fatality Assessment and Control Evaluation (MIFACE) Program.[8] This is in comparison to 19 in 2016, 19 in 2017, 23 in 2018 and 32 2019.

By comparison, the employer-based system from BLS estimated 1,200 farm injuries for Michigan with 600 injuries and a rate of 4.0 per 100 full-time equivalents in 2020, and 600 injuries and a rate of 3.4 per 100 full-time equivalents in 2021 (Table 11).[5] Similarly to Michigan's surveillance, the BLS' estimates and rates for 2020 and 2021 decreased when compared to previous years (1,300 and 6.6 in 2017, 1,000 and 4.7 in 2018, and 800 and 4.0 in 2019). 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 2020-2021*

Industry	2020				2021			
	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]
Agriculture[1]	600	4.0	200	1.8	600	3.4	300	1.8
Crop Production[2]	300	2.6	100	1.3	400	3.7	200	2.1
Animal Production and Aquaculture[2]	300	5.3	100	2.2	200	2.7	100	1.3

*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 estimate of Michigan non-fatal work-related farm injuries involving days away from work with or without job transfer or restriction for 2020 was analyzed by age groups, location and type of injury[7] (BLS estimate for 2021 was not available at the time of completion of this report). Farm injuries of upper extremities were the most common location both in the BLS data set (50.0%) and in the Michigan surveillance system (40.0%). Farm injuries among 25-34 year old's were the most common age group in the BLS data set (33.3%), while ≥65 year old's were the most common age group in the Michigan surveillance system (19.4%). Soreness, pain was the most common type of injury in the BLS data set (71.4%), while fractures were the most common type of injury in the Michigan surveillance system (27.4%).

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 2020 through 2021. The data from the Michigan Hospital Administrative (MHA) 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 2020 and 2021; 90 and 93 respectively, than the Michigan's surveillance system. The number of injuries identified in the MHA database with workers' compensation as payor was down to a greater extent than the percentage decrease in the number of injuries from 2017, 2018 and 2019; 202, 162 and 137 cases, respectively.

The Workers' Compensation database identified only 44 (5.3%) of the 826 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 45 agricultural fatalities (26 in 2020 and 19 in 2021) 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 thirty-nine 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). 2020 and 2021 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 2020. 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