Work-Related Farm Injuries in Michigan: First Report (January 2015 – December 2016)

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

Department of Medicine
909 Fee Rd., Room 117
West Fee Hall
East Lansing, MI 48824

May 4, 2018

Work-Related Farm Injuries in Michigan:

First Report

(January 2015 – December 2016)

Michigan State University

Joanna Kica, MPA
Kenneth Rosenman, MD

Author affiliations: Joanna Kica and Kenneth Rosenman are with Michigan State University, Department of Medicine, West Fee Hall, 909 Fee Rd., Room 118, East Lansing, MI 48824.

Acknowledgement: Thomas Largo, MPH. Michigan Department of Health and Human Services, Bureau of Epidemiology and Population Health.

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 first report on occupational farm-related injuries in Michigan; it covers two years, 2015 and 2016. These are the key findings:

- Work-related farm injuries were identified through hospital medical records
  - In 2015, there were 677 work-related farm injuries in 668 individuals, nine individuals had two injuries.
  - In 2016, there were 882 farm work-related injuries in 871 individuals.
  - Over the two years combined, there were 1,559 work-related farm injury incidents that represented 1,525 individuals; 20 individuals each sustained 2 unique farm injuries in the same calendar year, 13 individuals had 2 unique farm injuries in two different calendar years and one individual who sustained two unique farm injuries in two different calendar years and a second injury in one of the calendar years.
- The most common type of medical encounter was an emergency department visit (1,347; 86.4%).
- Seventy-four percent of all farm-related injuries were among men, 89.5% were among Caucasians.
- The most common part of the body injured was an upper limb (2,287; 38.2%), followed by a lower limb (663; 23.7%).
- The most common type of injury were contusions (412; 26.4%) and fractures (311; 19.9%) which accounted for almost half of all farm injuries.
- Injuries caused by cows were the predominant cause of work-related farm injuries and accounted for one third (472; 31.5%) of all injuries. Dairy farms accounted for 39.6% of all cases for which the farm type was recorded by a health care provider.
- Owners/operators accounted for 44.1% and hired hand for 42.9% of all individuals working on a farm.
- Commercial insurance was the expected payer in 557 (41.7%) cases, followed by Workers' Compensation in 323 (24.2%) cases.

BACKGROUND

This is the first report on work-related farm injuries in Michigan. The report is based on data for 2015 and 2016.

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] The Michigan work-related farm injuries surveillance system is used to identify causes of work-related farm injuries, target interventions to reduce these injuries and evaluate the effectiveness of these interventions.

The U.S. Bureau of Labor Statistics (BLS), the official source of work-related injury statistics, identified 1,000 work-related agricultural injuries in 2015 in Michigan, 500 were with days away from work, job transfer or restriction (incidence rate of 5.2 and 2.6 workers per 100 full-time workers, respectively), and 700 in 2016, 500 were with days away from work, job transfer or restriction (incidence rate of 4.1 and 2.8 workers per 100 full-time workers, respectively) (Table 1).[2] The BLS estimates are based on employer reporting through the Survey of Occupational Injuries and Illnesses (SOII). The BLS estimate does not include farm owners, their family members or farms with fewer than 11 employees.

Table 1. Number and Incidence Rates of Work-Related Farm Injuries by Industry and Case Types, Michigan 2015-2016*

Industry	2015				2016			
	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]	1,000	5.2	500	2.6	700	4.1	500	2.8
Crop Production[2]	500	4.7	300	2.8	400	4.1	200	2.1
Animal Production and Aquaculture[2]	500	5.7	200	2.5	300	4.1	300	3.4

*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)

According to the U.S. Department of Agriculture 2012 Census of Agriculture for Michigan, there were 52,194 farms in Michigan with 80,304 operators, 83,451 hired farm labor, 53,797 unpaid workers and 49,135 migrant and seasonal laborers.[3] Hired labor includes paid family members, bookkeepers, office workers, maintenance workers, etc., if their work was primarily associated with agricultural production. Hired farm workers excludes contract (migrant) workers and operators identified as a hired manager. The Census divides hired farm workers into two categories based on the duration of work in a calendar year: working 150 days or more (25,710 workers) or less than 150 days (57,741 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 2012 Agricultural Census, only the number of farms utilizing migrant labor. The Michigan Migrant and Seasonal Farmworker Enumeration Profiles Study (Update June 2013) estimated 49,135 migrant and seasonal farm laborers.[4] Seasonal farm labor was described as “an individual whose principal employment is in agriculture on a seasonal basis, who has been so employed within the last twenty-four months.”

Michigan State University's College of Human Medicine, Occupational and Environmental Medicine Division[5] operates the farm-related injuries surveillance system as the bona fide agent for the State.

Farm operators and workers identified with serious injuries receive a letter informing them about the Michigan AgrAbility Program.[6] Michigan AgrAbility is a program of Michigan State University Extension and Easterseals of Michigan, a private charity, which provides on-farm services to farmers with injury, illness or disability so they can continue to work longer and feel better. Michigan AgrAbility designs specific adaptive tools for a farmer's situation so he or she can work longer and feel better.

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 ED notes were reviewed to differentiate the work and non-work-related farm 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 (any age) receiving medical treatment at a Michigan hospital/ED/hospital outpatient for whom:

(a) A farm injury-related ICD-9-CM diagnosis code (Internal Classification of Diseases, Ninth Revision, Clinical Modification)[7] or ICD-10-CM diagnosis code[8] was assigned (Table 2), 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.

Table 2. Work-Related Farm Injury ICD-9-CM and ICD-10-CM Diagnosis Codes*

Farm-Related Injury ICD-9 and ICD-10 Codes		
ICD-9 Code	ICD-10 Code	Description
989.0, 989.1	T65.0, T65.1	Toxic Effect Cyanides, Strychnine
E827.0-.9	V80	Animal-Drawn Vehicle Accidents
E849.1	Y92.7	Place of Occurrence - Farm
E906.8	W55.1-.4	Other Injury Caused by Animal
E919.0	W30	Accidents Caused by Agricultural Machinery

*As of October 1, 2015, International Classification of Disease, Tenth Revision Clinical Modification (ICD-10-CM), has replaced ICD-9-CM.

Information from the hospital/ED medical 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 a migrant worker, occupation type, farm information (type, name, address), injury date, 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' Compensation Agency (WCA) 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. Information from Workers' Compensation on 78 matched cases was added to the database. Information who qualified for an AgrAbility letter was recorded in the database.

Data analysis was performed using queries conducted in Microsoft Access. Farm injury Agriculture Industry rates were calculated using Department of Agriculture 2012 Census of Agriculture for Michigan and the Michigan Migrant and Seasonal Farmworker Enumeration Profiles Study (Update June 2013) for denominators.[3]

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 2012 Census of Agriculture for Michigan, 768 farms indicated that they utilized migrant workers as part of their hired or contract workers and 94 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. Due to the above uncertainties regarding the true total number of hired, unpaid, and migrant/seasonal workers, and which of these categories may overlapping, two incidence rates were calculated. The first incidence rate utilized the number of operators, hired farm labor, unpaid workers and migrant/seasonal laborers; the second incidence rate assumed that all were included in the hired hand category. Rates were presented as a range using these two denominators, 217,552 and 266,687, respectively.

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).[2] 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.

The BLS Occupational Injuries, Illnesses and Fatal Injuries Profiles online tool was used to generate the 2015 and 2016 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 occupation for both private and public ownerships.[9,10] Code 452000 (Agricultural Workers) was used to generate the estimates and incidence rates.

RESULTS

In 2015, there were 677 work-related farm injuries in 668 individuals because nine individuals had two injuries. The rate was between 253.8/100,000 workers (migrant/seasonal laborers included in the denominator) and 311.2/100,000 (migrant/seasonal laborers not included in the denominator). In 2016, there were 882 work-related farm injuries in 871 individuals because eleven individuals each had two farm injuries. The rate was 330.7- 405.4/100,000 workers. Thirteen individuals sustained farm injuries in both 2015 and 2016. One individual sustained three unique farm injuries, two in one calendar year and one in 2015 and one in 2016.

There were an additional 49 agricultural fatalities (21 in 2015 and 28 in 2016) identified by the Michigan Fatality Assessment and Control Evaluation (MIFACE) Program.[11]

2015-2016 Combined: There were 1,559 work-related farm injuries in 1,525 individuals because twenty individuals each sustained two farm injuries in the same calendar year and fourteen individuals had a farm injury in both, including one individual who also sustained a third unique injury in one of the calendar years.

Type of Medical Encounter

An emergency department visit was the most common type of medical encounter, 1,347 (86.4%) cases (Table 3). Eleven percent of individuals were hospitalized due to the farm injury they sustained and 2.6% were seen at a hospital based clinic.

Table 3. Work-Related Farm Injuries by the Type of Medical Encounter, Michigan 2015-2016

Medical Encounter Type	Number	Percent
Emergency Department	1,347	86.4
Hospitalization	171	11.0
Outpatient	41	2.6
Total	1,559	100.0

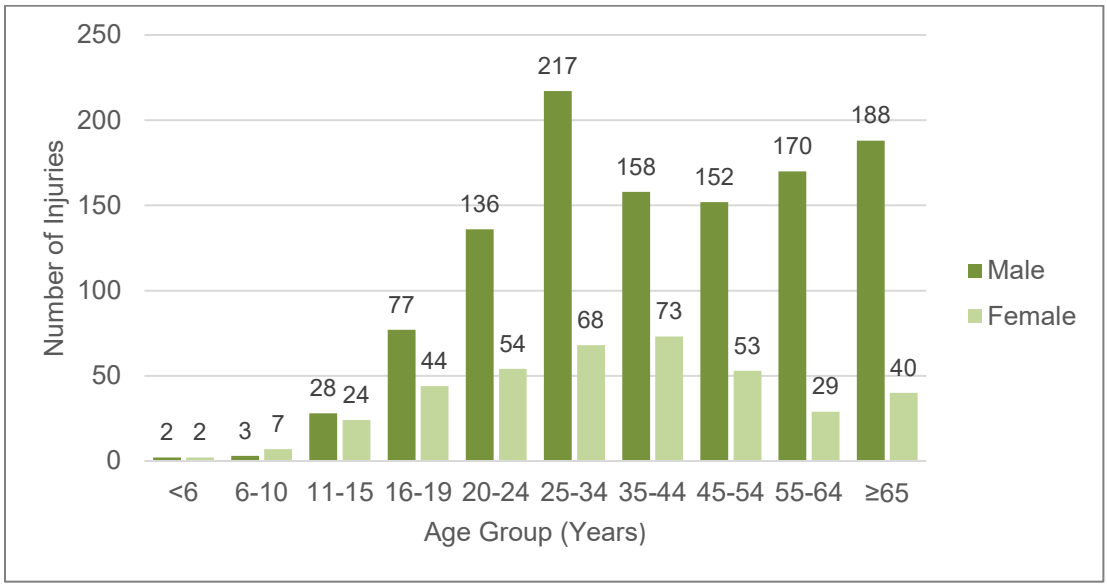
Characteristics of Injured Farm Operators and Workers

Age and Gender

The age of injured farm operators and workers varied from 4 to 86 years. The average age was 41.4 and the median age was 39.0. One thousand one hundred and thirty-one (74.2%) 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 25-34 and 65+ age groups, 217 and 188, respectively. For females, the age groups with the highest number of farm injuries were 35-44 and 25-34 with 73 and 68 injuries, respectively.

There were fourteen children 10 years and under who performed chores on a farm. Examples of causes of injuries while doing farm chores included: a four-year old struck in the forehead by a large angle iron that was leaning against a barn door and fell; having a thumb pinched in a tractor machinery; struck in the head by a barn door; a four-year old kicked in the abdomen by a horse; a five year old kicked in the face by a horse; slipping while herding animals; running into a fence while attempting to catch a pig; being bitten by a pig; having a thumb caught between a cart and a door; being hit in the head with an animal lead rope while walking goats; a five-year old whose foot was caught in a conveyor belt while sorting potatoes.

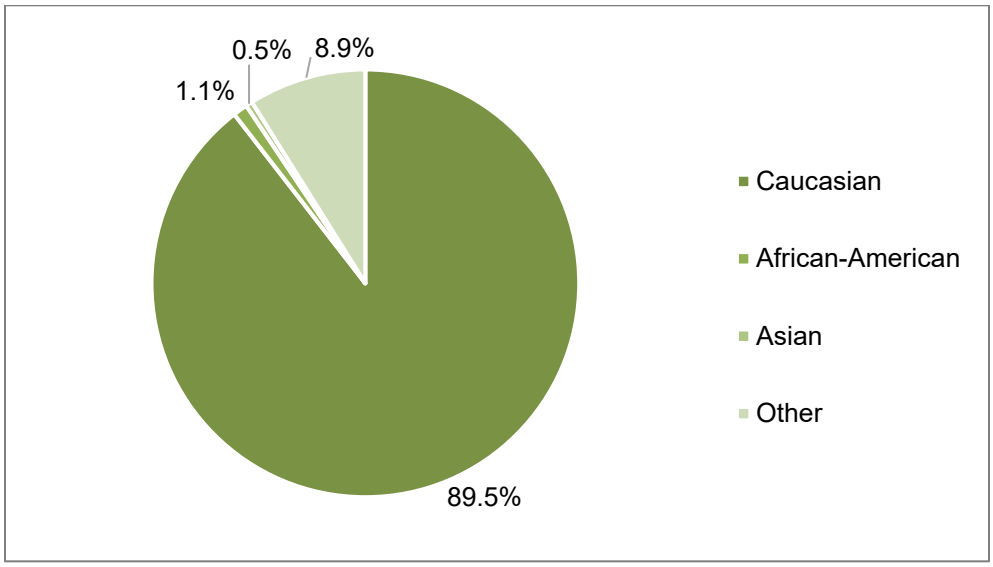
Figure 1. Work-Related Farm Injuries by Age Groups and Gender, Michigan 2015-2016



Race and Ethnicity

The race of farm operators and workers with work-related farm injuries was available for 750 (49.2%) of the individuals; 671 (89.5%) were Caucasian, 8 (1.1%) were African-American, 4 (0.5%) were Asian, and 67 (8.9%) were “Other” (Figure 2).

Figure 2. Race Distribution of Work-Related Farm Injuries, Michigan 2015-2016*



*Information on race was available for 750 (49.2%) individuals.

Information on ethnicity was provided for 439 (28.8%) individuals. Of the 439 individuals, 181 individuals (41.2%) were of Hispanic origin. Hispanic workers were more likely to be hired hand (96.8%) than non-Hispanic workers who were more likely to be owner/operators (52.6%) (Table 4). Most farm injuries in Hispanic and non-Hispanic workers occurred on dairy farms, with 63 (42.9%) and 42 (30.5%) cases, respectively (Table 4). Injured Hispanic workers were more likely to have worked on fruit and vegetable farms (38.8%) than non-Hispanic workers (10.1%) 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 2015-2016

Occupation Type[1]	Hispanic Workers		Non-Hispanic Workers	
	Number	Percent	Number	Percent
Hired hand	151	96.8	73	35.3
Owner/operator	3	1.9	109	52.6
Family member	2	1.3	25[3]	12.1
Total	156	100.0	207	100.0
Farm Type[2]	**Hispanic Workers**		**Non-Hispanic Workers**	
	Number	Percent	Number	Percent
Dairy	63	42.9	42	30.5
Fruit	41	27.9	5	3.6
Vegetable	16	10.9	9	6.5
Livestock	8	5.4	37	26.8
Grain	8	5.4	21	15.2
Other	7	4.8	19	13.8
Poultry	4	2.7	5	3.6
Total	147	100.0	138	100.0

[1]Information on both ethnicity and occupation type was available for 363 (82.7%) individuals.

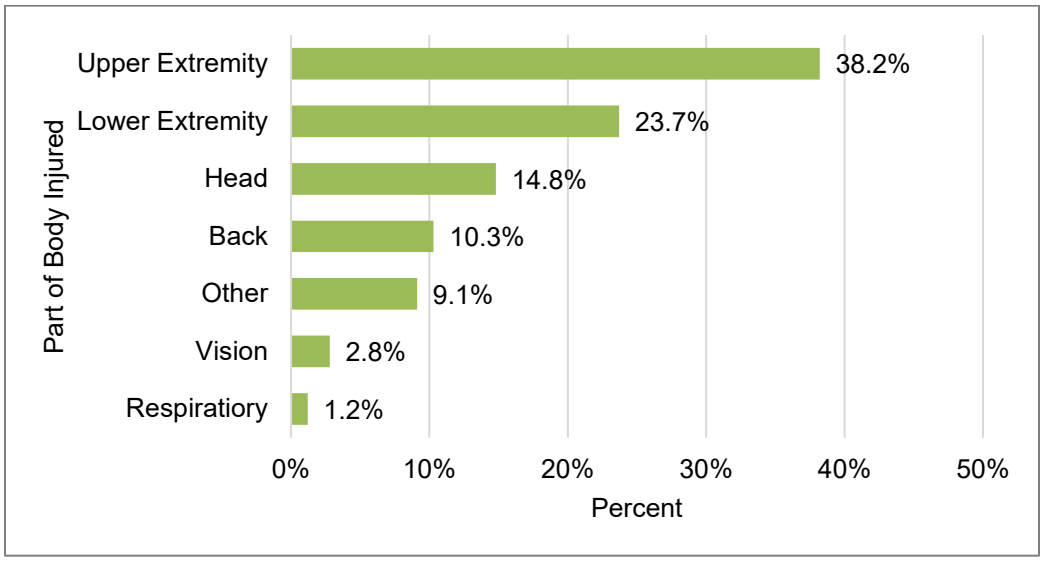
[2]Information on both ethnicity and farm type was available for 285 (64.9%) individuals.

[3]Includes 2 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 identified in the medical records. Farm injuries of upper limbs occurred most often (38.2%), followed by injuries of lower limbs (23.7%).

Figure 3. Work-Related Farm Injuries by Part of Body Injured, Michigan 2015-2016



Injury Source

For 1,500 (96.2%) 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. The next most common sources were Injuries from machines other than a tractor (e.g. combine, corn husker, auger, hay bailer) (10.4%) and falls from height (8.6%). 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, dropping a heavy object on feet, cutting hand on a fence.

Table 5. Work-Related Farm Injuries by Injury Source, Michigan 2015-2016*

Injury Source	Number	Percent
Cattle	472	31.5
Other	296	19.7
Non-Tractor Machine	156	10.4
Fall from Height	129	8.6
Fall at Ground Level	114	7.6
Livestock	102	6.8
Tractor	99	6.6
Horse	59	3.9
Tool	58	3.9
Chemical	11	0.7
Poultry	4	0.3
Total	1,500	100.0

*Information on injury source was available for 1,500 (96.2%) cases.

Nature of Injury

The most common type of injury was contusion, in 26.4% of individuals, followed by fractures, in 19.9% of individuals (Table 6). These two natures of injury accounted for almost half of all types of injuries identified.

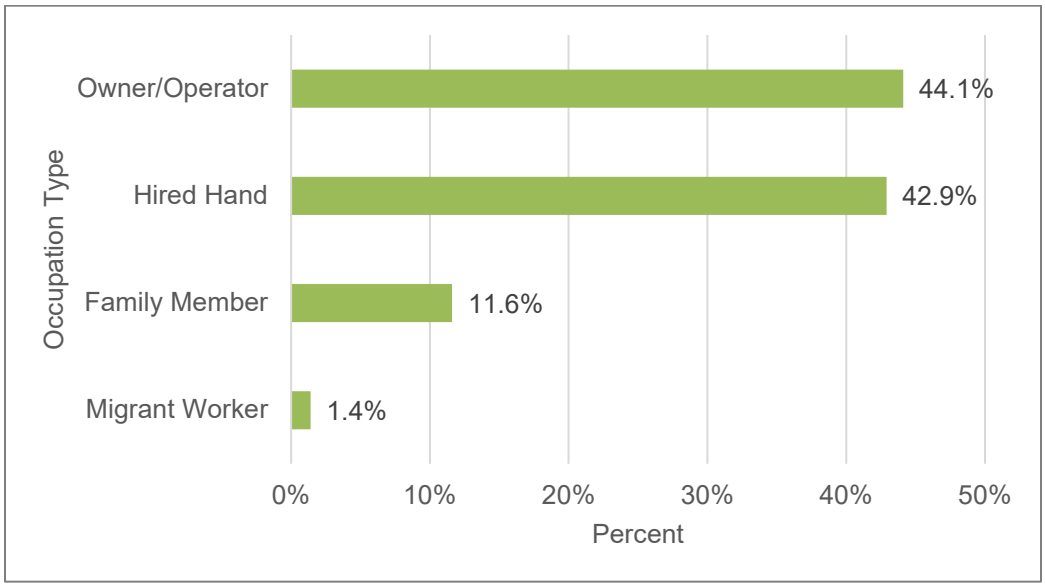
Table 6. Work-Related Farm Injuries by Nature of Injury, Michigan 2015-2016

Nature of Injury	Number	Percent
Contusion/Bruise	412	26.4
Fracture	311	19.9
Laceration/Cut/Puncture	231	14.8
Other	172	11.0
Sprain/Strain	153	9.8
Head Injury (no fractures)	78	5.0
Crushing Injury	66	4.2
Abrasion	32	2.1
Amputation	27	1.7
Concussion	22	1.4
Burn	20	1.3
Dislocation	17	1.1
Animal Bite/Sting	14	0.9
Open Wound	4	0.3
Total	1,559	100.0

Occupation Type

For 77.8% of all medical records, the occupation type was specified. Owner/operators accounted for 44.1% of all the individuals injured, followed by hired farm labor with 42.9%, family members with 11.6% and migrant workers with 1.4% of all individuals (Figure 4). There were additional 10 individuals who were not family members but assisted on a farm.

Figure 4. Work-Related Farm Injuries by Occupation Type, Michigan 2015-2016*



*Occupation type was specified for 1,187 (77.8%) individuals.

County of Residence and County of Farm

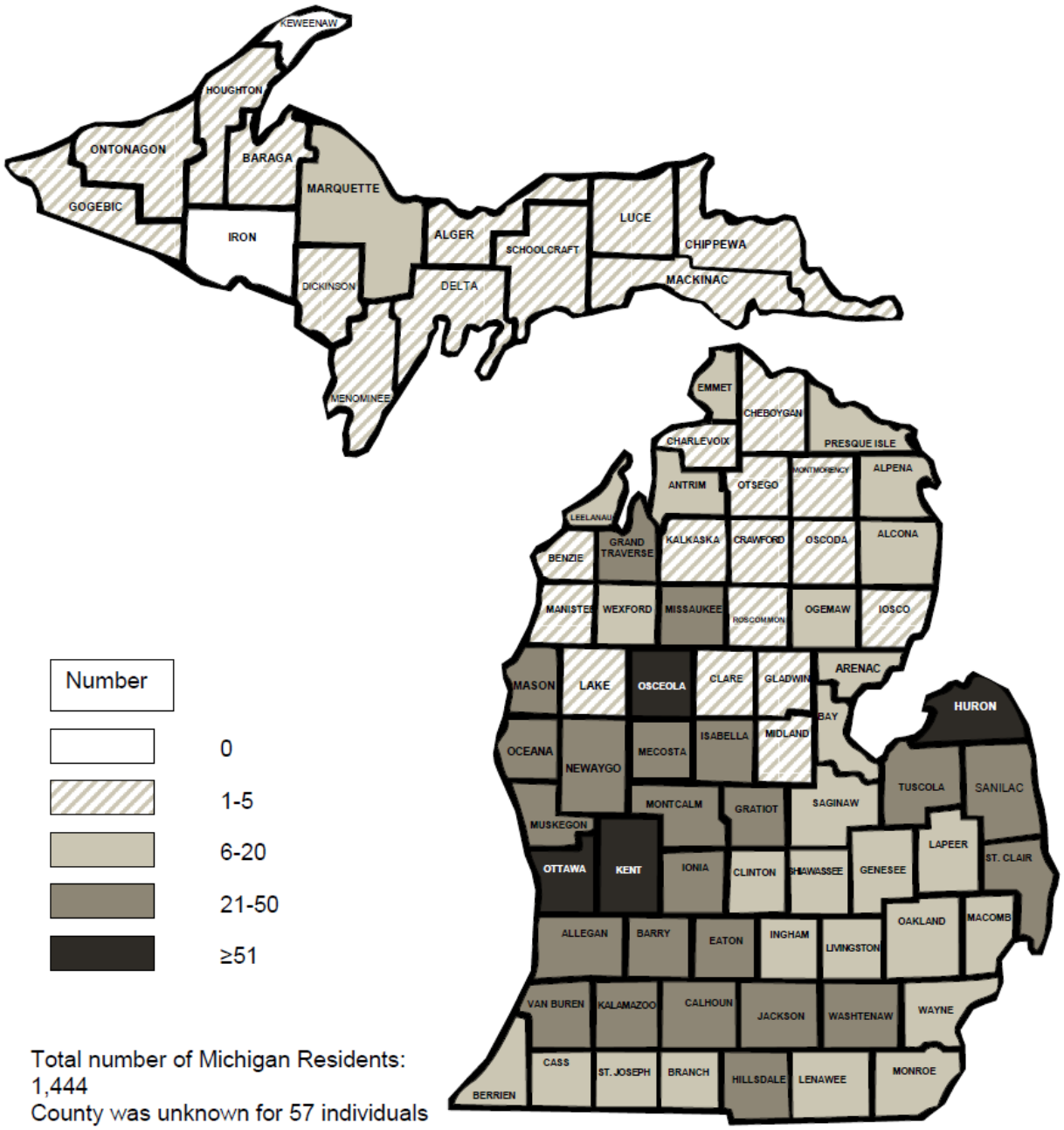
There were 1,444 Michigan Residents for whom the county of residence was known. There were 24 out-of-state workers, and for 57 Michigan residents county was unknown. It should be noted that the county of residence would not necessarily be the same county where the individual was injured and where the farm was located. Huron County had the highest number of residents with a work-related farming injury with 113 (7.4%) cases, followed by Ottawa County with 62 (4.1%) cases, and then Kent County with 57 (3.7%) cases (Table 7 and Figure 5).

Information on the county where the farm was located and where injury occurred was largely unavailable in the medical records. It was specified for 657 (42.1%) cases (Table 8 and Figure 6). Huron County had the highest number of farm work-related injuries with 37 (2.4%) cases, followed by Oceana County with 36 (2.3%) cases, and then Missaukee County with 29 (1.9%) cases.

Table 7. Number and Percent of Individuals with Work-Related Farm Injuries by County of Residence, Michigan 2015-2016

Michigan County	2015-2016		Michigan County	2015-2016	
	Number	Percent		Number	Percent
Alcona	7	0.5	Leelanau	10	0.7
Alger	1	0.1	Lenawee	6	0.4
Allegan	43	2.8	Livingston	15	1.0
Alpena	15	1.0	Luce	2	0.1
Antrim	9	0.6	Mackinac	5	0.3
Arenac	6	0.4	Macomb	15	1.0
Baraga	1	0.1	Manistee	4	0.3
Barry	40	2.6	Marquette	8	0.5
Bay	9	0.6	Mason	23	1.5
Benzie	2	0.1	Mecosta	26	1.7
Berrien	9	0.6	Menominee	1	0.1
Branch	16	1.0	Midland	5	0.3
Calhoun	47	3.1	Missaukee	21	1.4
Cass	6	0.4	Monroe	10	0.7
Charlevoix	1	0.1	Montcalm	49	3.2
Cheboygan	4	0.3	Montmorency	4	0.3
Chippewa	5	0.3	Muskegon	26	1.7
Clare	3	0.2	Newaygo	31	2.0
Clinton	14	0.9	Oakland	10	0.7
Crawford	1	0.1	Oceana	48	3.1
Delta	4	0.3	Ogemaw	8	0.5
Dickinson	4	0.3	Ontonagon	1	0.1
Eaton	31	2.0	Osceola	52	3.4
Emmet	8	0.5	Oscoda	4	0.3
Genesee	19	1.2	Otsego	1	0.1
Gladwin	3	0.2	Ottawa	62	4.1
Gogebic	1	0.1	Presque Isle	8	0.5
Grand Traverse	28	1.8	Roscommon	2	0.1
Gratiot	26	1.7	Saginaw	13	0.9
Hillsdale	22	1.4	Saint Clair	27	1.8
Houghton	5	0.3	Saint Joseph	20	1.3
Huron	113	7.4	Sanilac	25	1.6
Ingham	11	0.7	Schoolcraft	2	0.1
Ionia	41	2.7	Shiawassee	14	0.9
Iosco	5	0.3	Tuscola	50	3.3
Iron	0	–	Van Buren	36	2.4
Isabella	34	2.2	Washtenaw	27	1.8
Jackson	32	2.1	Wayne	13	0.9
Kalamazoo	35	2.3	Wexford	16	1.0
Kalkaska	4	0.3	Out of State	24	1.6
Kent	57	3.7	Unknown	57	3.7
Keweenaw	0	–	**Total**	1,525	100.0
Lake	5	0.3			
Lapeer	17	1.1			

Figure 5. **Geographic Distribution of Individuals with Work-Related Farm Injuries by County of Residence, Michigan 2015-2016**

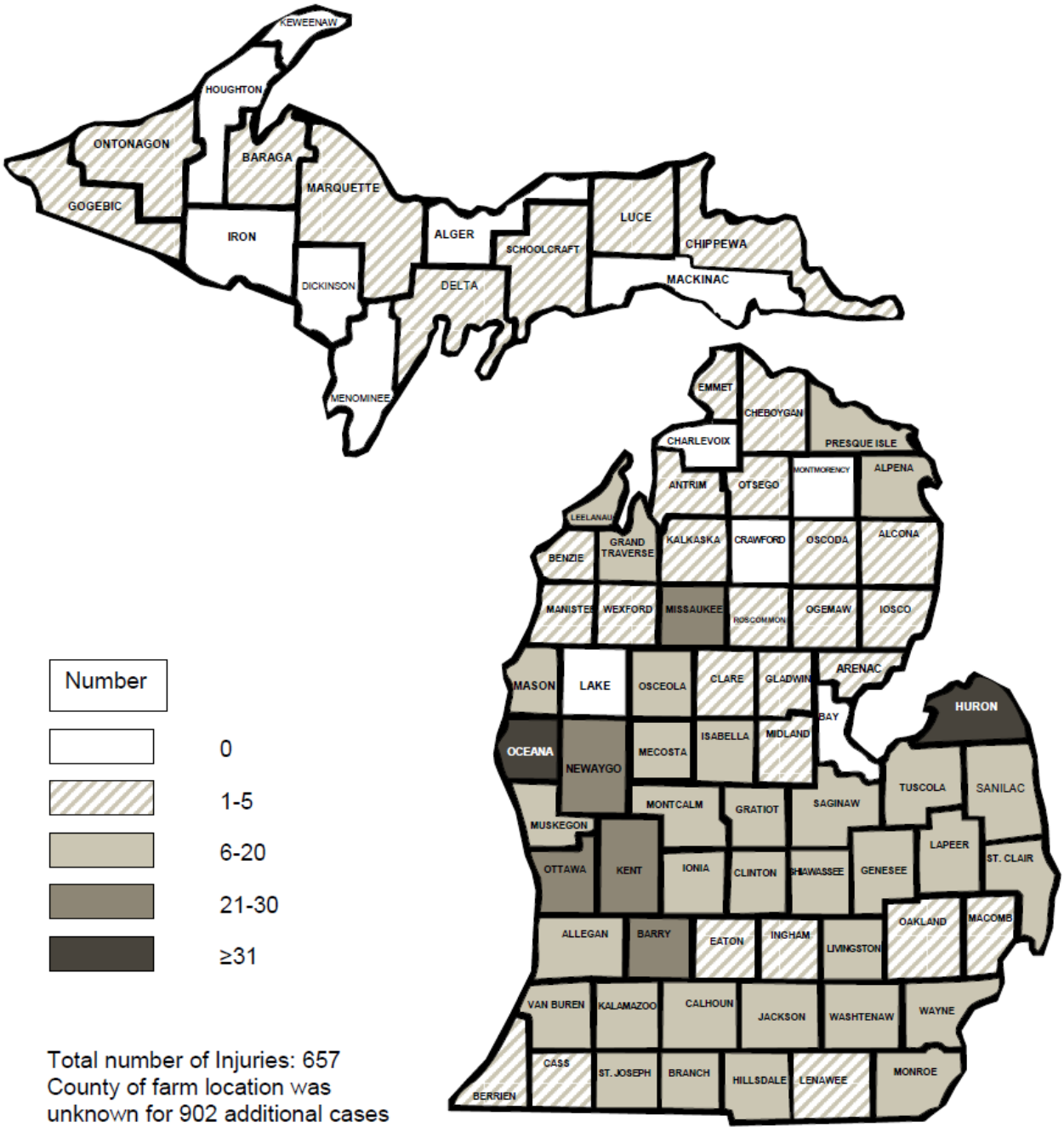


Total number of Michigan Residents: 1,444
County was unknown for 57 individuals and additional 24 individuals were out of state

Table 8. Work-Related Farm Injuries by County of Farm Location, Michigan 2015-2016

Michigan County	2015-2016		Michigan County	2015-2016	
	Number	Percent		Number	Percent
Alcona	2	0.1	Leelanau	7	0.5
Alger	0	–	Lenawee	3	0.2
Allegan	16	1.0	Livingston	13	0.9
Alpena	6	0.4	Luce	1	0.1
Antrim	5	0.3	Mackinac	0	–
Arenac	5	0.3	Macomb	5	0.3
Baraga	1	0.1	Manistee	2	0.1
Barry	23	1.5	Marquette	5	0.3
Bay	0	–	Mason	15	1.0
Benzie	1	0.1	Mecosta	6	0.4
Berrien	5	0.3	Menominee	0	–
Branch	6	0.4	Midland	3	0.2
Calhoun	19	1.2	Missaukee	27	1.8
Cass	4	0.3	Monroe	9	0.6
Charlevoix	0	–	Montcalm	18	1.2
Cheboygan	3	0.2	Montmorency	0	–
Chippewa	2	0.1	Muskegon	14	0.9
Clare	2	0.1	Newaygo	25	1.6
Clinton	11	0.7	Oakland	3	0.2
Crawford	0	–	Oceana	33	2.2
Delta	2	0.1	Ogemaw	2	0.1
Dickinson	0	–	Ontonagon	1	0.1
Eaton	4	0.3	Osceola	20	1.3
Emmet	3	0.2	Oscoda	2	0.1
Genesee	9	0.6	Otsego	1	0.1
Gladwin	2	0.1	Ottawa	24	1.6
Gogebic	1	0.1	Presque Isle	6	0.4
Grand Traverse	9	0.6	Roscommon	1	0.1
Gratiot	12	0.8	Saginaw	6	0.4
Hillsdale	10	0.7	Saint Clair	9	0.6
Houghton	0	–	Saint Joseph	9	0.6
Huron	36	2.4	Sanilac	7	0.5
Ingham	4	0.3	Schoolcraft	3	0.2
Ionia	20	1.3	Shiawassee	10	0.7
Iosco	4	0.3	Tuscola	12	0.8
Iron	0	–	Van Buren	11	0.7
Isabella	12	0.8	Washtenaw	17	1.1
Jackson	7	0.5	Wayne	6	0.4
Kalamazoo	19	1.2	Wexford	5	0.3
Kalkaska	3	0.2	Unknown	887	58.2
Kent	23	1.5			
Keweenaw	0	–	**Total**	1,525	100.0
Lake	0	–			
Lapeer	6	0.4			

Figure 6. **Geographic Distribution of Work-Related Farm Injuries by County of Farm Location, Michigan 2015-2016**



Total number of Injuries: 657
County of farm location was unknown for 902 additional cases

Farm Type

Information on farm type was largely underreported in the medical records. It was available for 903 (57.9%) cases (Table 9). When farm type was recorded by a health care provider, dairy farms accounted for 39.6% of all cases, followed by livestock farms with 23.6% of cases (Table 9).

Table 9. Work-Related Farm Injuries by Farm Type, Michigan 2015-2016*

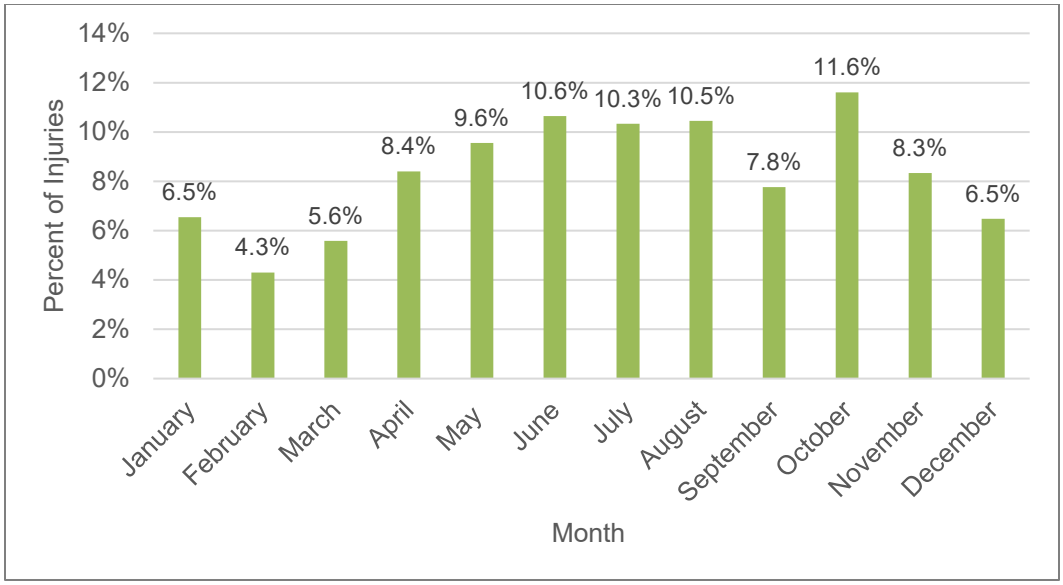
Farm Type	Number	Percent
Dairy	358	39.6
Livestock	213	23.6
Other	98	10.9
Grain	80	8.9
Vegetable	65	7.2
Fruit	62	6.9
Poultry	27	3.0%
Total	903	100.0%

*Information on farm type was available for 903 (57.9) cases

Month of Injury and Farm Type by Seasonality

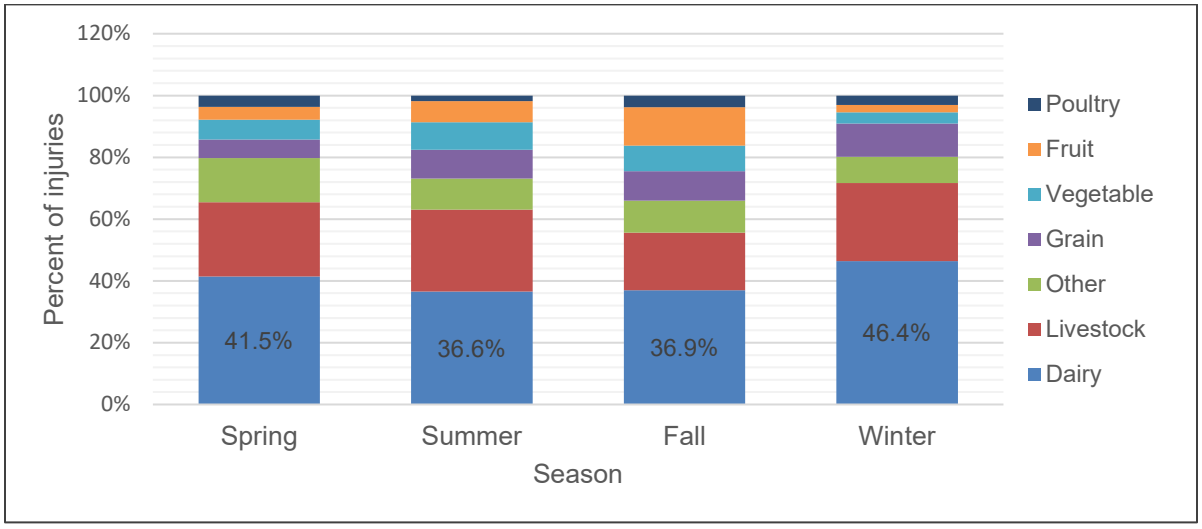
Information when injury happened was available for all cases. More injuries occurred in summer months, however October was the month with the highest number of injuries (181, 11.6%).

Figure 5. Work-Related Farm Injuries by Month of Injury, Michigan 2015-2016



Work-related farm injuries at dairy farms accounted for 36-46% of all identified injuries throughout all the seasons. Injuries at both fruit and vegetable farms were the most common during summer and fall seasons, with 6.8%-12.4% and 9.0%-8.3% respectively. Grain farms had the most injuries in the wintertime (10.8%) and livestock farm in the summer (26.5%).

Figure 6. Work-Related Farm Injuries by Farm Type and Seasonality, Michigan 2015-2016



Source of Payment

Commercial Insurance was the expected payer in 557 (41.7%) cases, followed by Workers' Compensation in 323 (24.2%) cases, Medicare or Medicaid in 321 (24.1%) cases and self-pay in 133 (10.0%) of cases (Table 10). For 225 farm injuries, payment source could not be identified.

Table 10. Work-Related Farm Injuries by Expected Source of Payment, Michgan 2015-2016

Expected Source of Payment	Number	Percent
Commercial	557	41.7
Workers' Compensation	323	24.2
Medicare/Medicaid	321	24.1
Self Pay	133	10.0
Total	1,334	100.0

Data Source: Michigan hospital/ED records

*Payment source was unknown for 225 (14.4%) cases

Industrial Hygiene Inspection

In 2015, Michigan OSHA inspected one workplace where a farm injury occurred. A male employee in his mid-fifties reached into the Hop Flour Mixing chamber to brush down the last flour into the conveyor and as he was brushing, his right glove became caught in the revolving mixing arms of the hopper. The employee sustained multiple right forearm fractures with displacement. The equipment's e-stop button has not been pushed before the employee swept out the hopper.

The company was cited for one serious violation of MIOSHA safety rules: “A point of operation guard or device shall be as prescribed in a specific standard, or, in the absence of a specific standard, shall be designed and constructed, when required, to prevent the machine operator exposed to the hazard from having any part of his body in the hazardous area during the operating cycle.” The citation was directly related to the injury. The company had not corrected the hazard at the time of the inspection.

Picture of Hop Flour Mixing Chamber

DISCUSSION

This is the first report on work-related farm injuries in Michigan. It covers two years, 2015 and 2016. Michigan surveillance has identified 1,559 work-related farm injuries in 1,525 individuals (twenty individuals each sustained two unique farm injuries in the same calendar year and fourteen individuals had two unique farm injuries in two different calendar years, including one individual who also sustained a third unique injury in one year). The rate was between 253 and 311 per 100,000 workers in 2015 and between 330 and 405 per 100,000 workers in 2016, depending if migrant/seasonal laborers are included or not as a separate category of farm labor or if they are included as a part of the hired hand workers. The employer-based system estimated 1,700 farm injuries for Michigan with a rate of 520 per 100,000 full time equivalents in 2015 and 410 per 100,000 full time equivalents in 2016.[2] The BLS rates are higher because they reported more injuries and the denominator used to calculate the rates does not include farm owners/operators, family members and farm workers who work on farms with less than 11 employees, which were included in Michigan surveillance.

BLS reported 680 (390 in 2015 and 290 in 2016) non-fatal work-related farm injuries involving days away from work by selected worker and case characteristics for Michigan.[9,10] Farm injuries of upper extremities were the most common location both in the BLS data set (240; 35.5%) and in the Michigan surveillance system (595; 38.2%). Most farm injuries occurred in farm operators and workers in the 25-34 age group, both in BLS and Michigan surveillance, with 320 (47.1%) and 285 (18.7%), respectively.

Workers' Compensation was identified as the payer for only 24.2% of the work-related farm injuries treated at Michigan hospital and emergency department in 2015 and 2016. Michigan Hospital Administrative Database where workers' compensation was the primary expected payer and place of occurrence was farm, identified even smaller number of farm work-related injuries in 2015 and 2016, with 73 (18.1%) and 153 (18.2%) cases, respectively.

The Workers' Compensation database identified only 78 (5.0%) of the 1,559 work-related farm injuries. The possible explanations for the Workers' Compensation difference include: 1) The WCA data set only included farm injuries that caused 7 or more

consecutive days away from work, presumably the most severe cases; 2) Agricultural employers if they employ less than 3 employees do not have to carry workers' compensation coverage; 3) WCA excluded the self-employed (Michigan's surveillance identified 523 owner/operators) and family members (Michigan's surveillance identified 138 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 WCA.

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 investigation completed at one farm identified major correctible problems.

Outreach activity included providing information on the Michigan AgrAbility Program[6] to farm operators and workers whose injury suggested they may have ongoing serious impairment. We have mailed eighty-five letters and AgrAbility brochures to individuals with more severe farm injuries who may have benefited from the AgrAbility Program's assistance.

We have developed educational materials for distribution to farm employers and employees where we see patterns in causes for the farm injuries; a hazard alert on safe animal handling and a second hazard alert on farm-related machine entanglements.[12] 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 Labor, Bureau of Labor Statistics. State Occupational Injuries, Illnesses and Fatalities. 2015 and 2016 Michigan Data, available at: https://www.bls.gov/iif/oshstate.htm

3. United States Department of Agriculture. 2012 Census of Agriculture for Michigan, available at: https://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_State_Level/Michigan/

4. The Michigan Migrant and Seasonal Farmworker Enumeration Profiles Study (Update June 2013), available at: https://www.michigan.gov/documents/dhs/FarmworkerReport_430130_7.pdf

5. Michigan State University's College of Human Medicine, Occupational and Environmental Medicine Division. Website: www.oem.msu.edu

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

7. Public Health Services and Health Care Financing Administration. International Classification Diseases, 9th Revision, Clinical Modification. Washington: Public Health Service, 1980.

8. 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

9. United States Department of Labor, Bureau of Labor Statistics' Occupational Injuries and Illnesses and Fatal Injuries Profiles, 2015. Data obtained by navigating through screens starting at the following website: http://data.bls.gov/gqt/InitialPage

10. United States Department of Labor, Bureau of Labor Statistics' Occupational Injuries and Illnesses and Fatal Injuries Profiles, 2016. Data obtained by navigating through screens starting at the following website: http://data.bls.gov/ggt/InitialPage

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

12. Work-Related Hazard Alerts: Safe Animal Handling to Prevent Farm-Related Injuries and Deaths. Michigan State University. Department of Medicine. Occupational and Environmental Medicine. http://www.oem.msu.edu/images/Alerts/AnimalHazardAlert.pdf