

2014-17 Iowa Trauma Registry Analysis and Summary of Agricultural Injuries

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2014-17 Iowa Trauma Registry: Analysis and Summary of Agricultural Injuries

Under a cooperative agreement with the Iowa Department of Public Health (2697-R3, Agricultural Injury Surveillance Project), data from the Iowa Trauma Registry were evaluated to investigate injury trends among Iowa farmers. These data were generated to provide information on the burden of injury to Iowa farmers using a surveillance database that includes all traumatic injuries presented at emergency rooms across the state. This document includes handouts for additional efforts to improve the safety and health of farmers.

1. Methods

Iowa Trauma Registry cases from 2014-2017 were used. These included cases coded with either ICD-9 or ICD-10 codes. All cases that were identified as Ag Related were entered (N=1594). Additional cases were also examined for inclusion. Criteria differed by ICD code system

For ICD-9, included cases that were:

- Off-road motor vehicle cases (E821),
- Accidental poisonings with ag/horticultural chemicals (E863),
- Natural/environmental (E900-E901) of heat, cold, pressure, animals, lightning; and
- Other accident causes of E919 and E925

Then, from these additional cases, used location code: included if specifically E849="farm"; excluded specifically if E849.3="industrial place or premise" or E849.4= "place of recreation and sport". Other cases were examined individually for inclusion. All other added cases were removed if the file indicated "not work related" and occupation identified anything other than "farming, forestry, fishing".

For ICD-10, cases were included if they specified:

- Contact with ag machinery (W30)
- Other land transport accidents had idenfied ag vehicle (V84).

These other cases were examined individually for inclusion; they were removed if the file indicated "not work related" and occupation identified anything other than "farming, forestry, fishing".

Only cases that included both CAUSE and DIAGNOSIS codes in the case report. The final case count was 1981.

Data that were available for this time period were coded either as ICD-9 (939 cases) or ICD-10 (1042 cases). To combine the data into one set, the ICD-10 cases were manually recoded into equivalent ICD-9 cause and diagnosis codes.



2. Results

Cases were categorized into five main categories, with sub-category information retained within "transportation" and "equipment interaction" categories. Table 1 summarizes these case counts by category groups, and Figure 1 illustrates the case counts with more detailed cause codes. Over all cases, 92% of the cases were from ten main ICD-9 cause categories. The "other" 171 cases made up the remaining 8% of the reports and were aggregated as an overall "Other" category for examining data trends.

The distribution of outcomes, by diagnosis codes, were also examined across all agricultural injury cases (Figure 2). Fracture and lacerations were the most prevalent injuries, but crushing injuries (N=50), amputations (47) and pneumothorax (23) injuries are highlighted due to the severity of these outcomes.

Following these aggregated data analyses, details within each of the cause code categories are presented in this document to identify the range of actions and risks that resulted in traumatic injuries to ag workers.

		1	% Additional	% Rehab/ Long -Term	
	Cause Category	#Cases	Treatment	Care	% Fatal
Falls		428	19	11	1
Transportation		416	19	10	2
	Nontraffic MV	189			
	Traffic MV	97			
	Other Land Transport	113			
	Other Transport (air, not classified)	17			
Interaction with Equipment		748	19	5	<1
	Struck By/Against	205			
	Contact with Machinery	312			
	Caught in/between	117			
	Cut/Pierce	114			
Natural/Environmental		235	11	8	<1
Other Categories		154	27	6	1
Final Case Count		1981			

Table 1: Cause Categories for 2014-17 Iowa Trauma Registry cases for agricultural workers.



Figure 1: Case counts by E-code causes (ICD-9 codes)









2.a Fall Cases

During this time period, 428 farmers (22%) were injured due to falls (ICD-9 E880-888). For 75% of the fall cases, details on the fall were provided (Fig. 3). While 57% of falls were from elevated levels (ladder, stairs, structures, etc.), around 18% were from slip/trip/stumbling resulting in a fall on the same level. Interventions examining multiple mechanisms of falls on the farm are needed. The outcome of these falls predominates with broken bones (52%), with other outcomes also categorized.







2.b Interactions with Equipment Cases

Data for cases that included an interaction with equipment included cases that were "struck by" (ICD-9 = E916-917), "caught in/between" (E918), "contact with equipment" (E919), and "cut/pierce" (E920). Aggregating across these categories, 748 (38%) of all farmer traumatic injuries were caused by equipment interactions.

Figure 4 illustrates the injury cause codes (left). In red, 18% of these cases were being struck by something (ICD E916-917, 205 cases). Equipment, supplies, or products were items that are included in the "falling object" category. Farmers being "caught in/between" (E918, N=117) included stationary objects (29% of these cases) and moving objects (71%). In blue, contact with equipment (E919, N=257) was dominated by agricultural equipment (combine, harvester, thresher, etc., all while not in transport), but these "contact" cases also included other equipment that may be in machine sheds and elsewhere on the farm. Farmers who were cut/pierced (E920, N-114) were cut by multiple types of equipment, identified in green.

On the right of Figure 4 are the distribution of outcome diagnoses. Both fractures (27%) and cuts/abrasions (39%) were the most common outcomes. Note that 43 amputations (6% of equipment cases; 2% of all farmer injuries) resulted from interactions with equipment.



Figure 4: Distribution of equipment interaction causes (left) and resulting distribution of diagnoses (right)



2.c Natural Injury Cause Cases

The ICD-9 category of "Natural and Environmental Factors" (E900-909) includes injuries caused by heat, cold, air pressure, poisonings, lightnings, and storms. For farmers in the trauma registry, **all** of the cases identified in this category were "animal caused injuries" (E906). Since the ICD-9 codes do not distinguish between animal types, the 122 cases reported in the database using ICD-10 codes were used to examine the distribution of traumatic injuries by animal.

Figure 5 illustrates that the majority of animal caused injuries were likely from horses and cows (left graph). For animal-caused injuries, 37% resulted in fractures, 20% in bruise/contusions/hemorrhages, and 19% cutting/abrading (right).

Figure 5: Distribution of animal-caused injuries (left) and resulting distribution of diagnoses (right)





2.d Vehicle/Transport Injury Cause Cases

During this 4-year period, 416 traumatic injuries were due to vehicle/transportation factors. This represents 42% of all cases.

Figure 6 illustrates the injury cause codes (left). The motor vehicle injuries in non-roadway events are in green (ICD E820-825), representing 45% of all vehicle injuries. The category "MV nontraffic off-road motor vehicles" cases references the 102 ATV/UTV cases over these four years. In red, motor vehicle events happening on roadways (E810-819) consisted of 97 cases. In black, other land transportation includes animal-related transportation: 106 cases of animal riding injuries were identified in the farmer database. The "other vehicles" include industrial and unspecified vehicles involved in these 17 cases.

On the right of Figure 6 are the distribution of outcome diagnoses. Again, fractures (46%) and bruise/contuse/hemorrhage (15%) are the most frequent outcome of these injuries.

Figure 6: Distribution of transportation/vehicle causes (left) and resulting distribution of diagnoses (right)





2.e "Other" Cause Cases

The remaining 154 injury cases (8% of all trauma cases) were aggregated to present as "Other". Figure 7 illustrates the range of these less frequent cases (left), which has a substantially different looking outcome chart associated with it (right). Given the nature of these cases, which includes fire, explosions, chemicals, and hot/corrosive substances, among other things, the most frequent health outcomes have changed to burns/electrocutions rather than fractures or cuts typical of other categories.







2.f Severity Assessment

Efforts to reduce injury to farmers may want to focus on more severe outcomes rather than case counts. Cases were examined within cause categories to examine the proportion of these cases with more severe outcomes. A severity ratio was computed by dividing the count of cases with moderate to severe ISS codes by the number of cases with mild ISS codes. Figure 8 identifies these data, with the outcome severity ranked high for:

- Other land transport, particularly animal riding injuries
- Motor vehicle traffic collision, particularly with other motor vehicles.
- Motor vehicle non-traffic, particularly with off-road vehicles
- Falls



Figure 8: Ranking of causes by severity ratio (in red)



2.g Injuries by Age

Basic analyses by age were performed to examine important trends. A major significant trend was identified for falls: older farmers experiencing more traumatic injuries associated with falls. A farmer 55 yo or older is 1.6 times more likely to seek emergency care for a fall than those younger than 55.

Figure 9: Injury cases by age





2.h Body Part Affected

The distribution of where injuries occurred on the body, across all cases, is given in Figure 10.



Figure 10: Injury by body part

Figure 11 identifies the body part injured across all *fracture cases*, combined with the injury cause code. Falls accounted for 30% of all fractures, with 40% of fall-fractures affecting the lower limb. Additional fracture cases were from contact with machine (14%), animals caused ("Natural", 12%), and motor vehicle non-traffic (11%).



Figure 11: Counts of Fracture Cases, by body part and injury cause code



3. Summary

These data were generated to provide information on the burden of injury to lowa farmers using a surveillance database that includes all traumatic injuries presented at emergency rooms across the state.

The inset below has some summary data, intended to communicate risks to farmers and their safety and health advocates. The next pages contain images of 2-page handouts developed for healthcare providers to use to discuss health and safety risks with farmer patients.

- □ Falls is the biggest risk factor sending farmers to the emergency room: 107 farmers/year (22% of farmer ER visits)
 - Severe outcomes: 1% of falls result in death
 - 52% of falls lead to fracture (lower limb injuries predominate)
 - Farmers >55 years old go to emergency room more often than younger workers on the farm
- □ Contacting machines, both agricultural and others, cause resulted in 78 ER visits by farm workers /year (16%)
 - Combined with getting caught in/between moving equipment, these two accounted for 87% of amputations
 - The tractor's PTO is not the only risk for amputation
- Animal injuries cause **12%** of emergency room visits (60 farmers/year)
 - Result in fractures (38%), lacerations (18%), or contusions (15%)
 - Horses (34%) and Cows (46%) are most frequent cause
 - Pig (5%), other hoof stock (5%), and other animals (7%) are also risks
- □ **Transportation** risks accounted for **21%** of ER visits (104 farmers/ year) -- These events are NOT just occurring on the road:
 - Roadway events result in 5% of all ER visits by farmers
 - Vehicle incidents off the road (on the farm and including ATVs/UTVs) result in 10% of all ER visits
 - Injuries from animal riding result in 5% of all ER visits



Have the Conversation about Injuries on the Farm

In Iowa between 2014-17, traumatic farm-related injuries resulted in 1981 ER visits. (1.8 farmer ER visits / day)

Falls caused 1 in 5 injuries

428 Falls (22%)	Injuries
One level to another*	141
Same level	76
Ladders*, scaffolding	59

Transportation was involved in 1 in 5 injuries

416 Transportation	Injuries
Animal Riders*	102
Off-road Vehicles*	102
Roadway Collisions*	65
Hit moving objects when off-road	46

Machine interactions caused 1 in 3 injuries

634 Interactions were:	Injuries
Contact with*	312
Struck by/against*	205
Caught in/between	117

FALLS

- The most common event sending farmers to the ER
- 1.6 times as many farmers

 <u>></u> 55 years old go to ER compared to younger farmers
- 1% of falls are fatal
- 52% of falls lead to broken bones

ANIMAL INJURIES

- Injuries from riding animals account for 5% of ER trips
- More importantly, another 12% of injuries (235 cases) were caused by being struck/contacted by animals:
 - · 80% by horses or cows
 - Outcomes include fractures, lacerations, and contusions

AMPUTATIONS

Getting caught in/between moving equipment accounted for **87%** of amputations



* At least one fatality occurred with this injury.

Injury data are from the Iowa Department of Public Health's Iowa Trauma Registry under agreement 2697-R3 "Agricultural Injury Surveillance Project".



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Most Prominent Farmer Injuries: 2014-17

Outcomes



Lacerations/Open Wounds: 22%



Fall223Contact with machine101Natural (animal caused)89Top Laceration CausesContact with machine104Cut/Pierce95Struck by/against65

Top Fracture Causes



Severe Outcomes

2% (47) Amputations



1% (20) Deaths

1 out of 4 farmer trips to ER end in farmer **needing more care**

- 18% need acute follow-up treatment
- 8% need long-term care



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