



2017-23 Iowa Trauma Registry Analysis and Summary of Farm-related Injuries

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2017 to 2023 Iowa Trauma Registry: Analysis and Summary of Farm-related Injuries

Under a cooperative agreement with the Iowa Department of Health and Human Services, data from the Iowa Trauma Registry were evaluated to describe farm-related injury in Iowa. This evaluation was completed to provide information on the burden of injury to Iowa farmers using an administrative database that includes traumatic injuries presented at emergency rooms across the state.

Methods

Individuals who received treatment for an injury in a hospital that reports injury cases to the Iowa Trauma Registry were included for the years **2017 to 2023**. The Iowa Trauma Registry defines farm-related injury cases as non-household injury incurred on the farm while handling, producing, processing, transporting, or warehousing farm commodities. All cases that were identified as Farm-related were included (**N=3753**).

Patient injuries were described by *mechanism* and *injury* using International Classification of Diseases, Tenth Revision (ICD-10). Injury mechanism, nature, and body part injured were identified by mapping diagnosis codes with injury matrixes (Hedegaard et al., 2019, 2020). The frequency of additional treatment requirements was described across the following categories: routine home discharge, acute care, long-term care, and fatal injury. Long-term care included inpatient rehabilitation, long term care hospital, and hospice care. All other forms of additional care were included as acute care. Additionally, an injury severity score for each injury was used to describe severity of injury across injury types.

The common injury mechanisms of *fall*, *contact with machinery*, *natural*, and *transportation* related were further described for mechanism and injury diagnosis. The frequency of injury to specific body regions was also described.

References

- Hedegaard, H., Johnson, R. L., Garnett, M. F., & Thomas, K. E. (2019). The International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM) External Cause-of-injury Framework for Categorizing Mechanism and Intent of Injury. *National Health Statistics Reports*, 136, 1–22.
- Hedegaard, H., Johnson, R. L., Garnett, M. F., & Thomas, K. E. (2020). The 2020 International Classification of Diseases, 10th Revision, Clinical Modification Injury Diagnosis Framework for Categorizing Injuries by Body Region and Nature of Injury. *National Health Statistics Reports*, 150, 1–27.

Results

Table 1 summarizes the injury cases by injury mechanism. Falls were the most common injury identified for 25.2% (n=949) of all injury cases. A similar number of Interaction with Equipment (n=939, 25.0%) and Transportation injuries (n=903, 24.1%) were identified. The other common farm-related injuries were those classified as natural/environmental, mostly made up of injuries from contact with animals.

The distribution of outcomes by specific injury cause codes are presented in Figure 1 along with the percentage of the injuries considered moderate/severe (ISS equal to 9 to 75) and minor (ISS equal to 0 to 8) based on the injury severity score (ISS). While rare, some records were missing injury information needed to calculate ISS and were therefore presented as not calculated (NC).

Injury diagnoses for farm-related injuries are presented in Figure 2. Fractures were the most common injury condition identified (n=2090, 55.7%). Nearly half (n=1732, 46.1%) of the injuries included more than one injury diagnosis. This most common injury combination was fracture and internal organ injury (n=542). This can occur when the thorax is injured resulting in a rib fracture and organ injury. The other common injuries co-occurring with a fracture were superficial (n=489, e.g., bruise) and open wound (n=438, e.g., muscle and tendon laceration)

Table 1: Cause Categories for 2017-2023 Iowa Trauma Registry cases for farm-related injuries (n=3753)

Cause Category		Injuries*	% Additional Treatment	% Rehab/ Long-Term Care	% Fatal
Fall		949	44.8	6.6	(S)
Transportation		903	37.5	3.2	1.8
	Nontraffic MV	336			
	Traffic MV	279			
	Other Land Transport	259			
	Other Transport (air, not classified)	29			
Interaction with Equipment		939	40.9	2.6	2.0
	Struck By/Against	285			
	Contact with Machinery	491			
	Cut/Pierce	163			
Natural/Environmental		576	33.9	2.3	(S)
Other Categories**		413	37.8	4.4	(S)
Unspecified/Not Identified		106			

(S) – Percent not presented for categories with less than 11 cases

*Total count from individual categories does not sum to patient total. There were 133 instances of additional injury mechanisms identified for a total of 3886 injury mechanisms identified for 3753 patients.

** Other categories include: drowning/submersion, fire/flame, hot object/substance, firearm, overexertion, poisoning, suffocation, child/adult abuse, foreign body

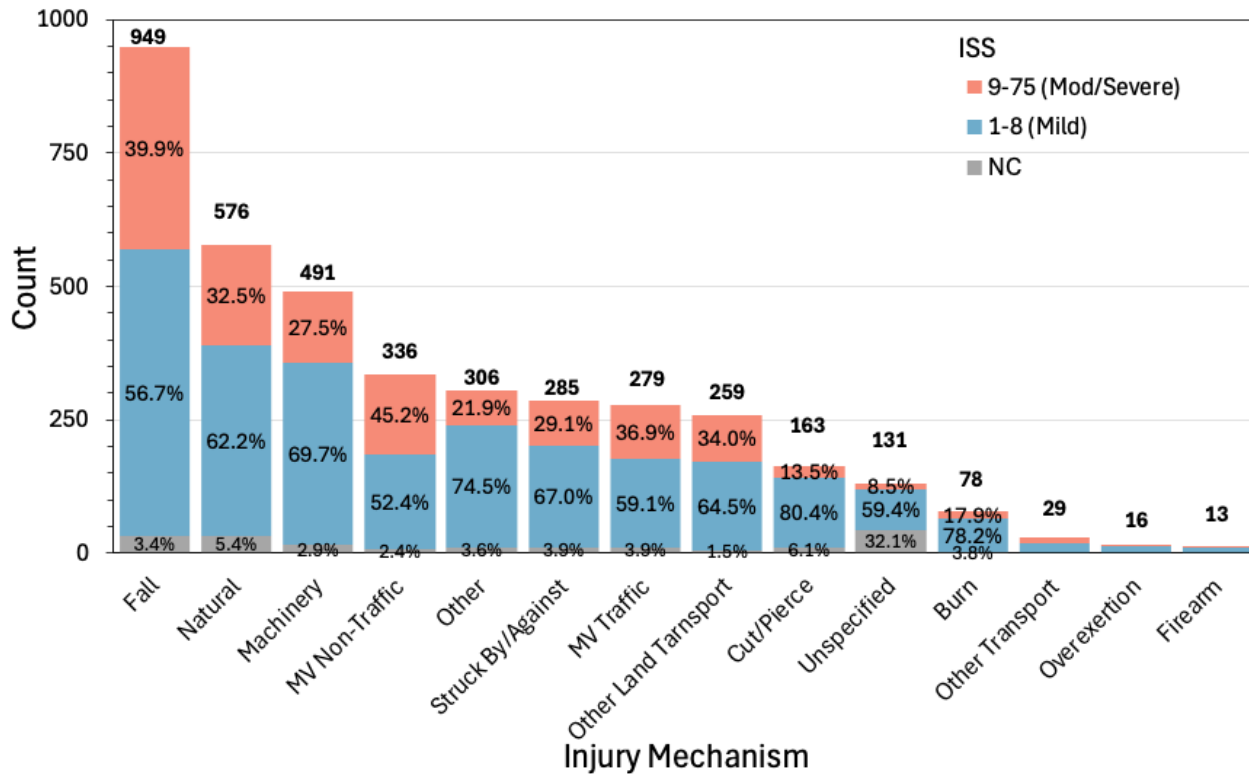


Figure 1: Farm-related counts and injury severity by injury causes, 2017 to 2023

Note: 3886 causes for 3753 injuries

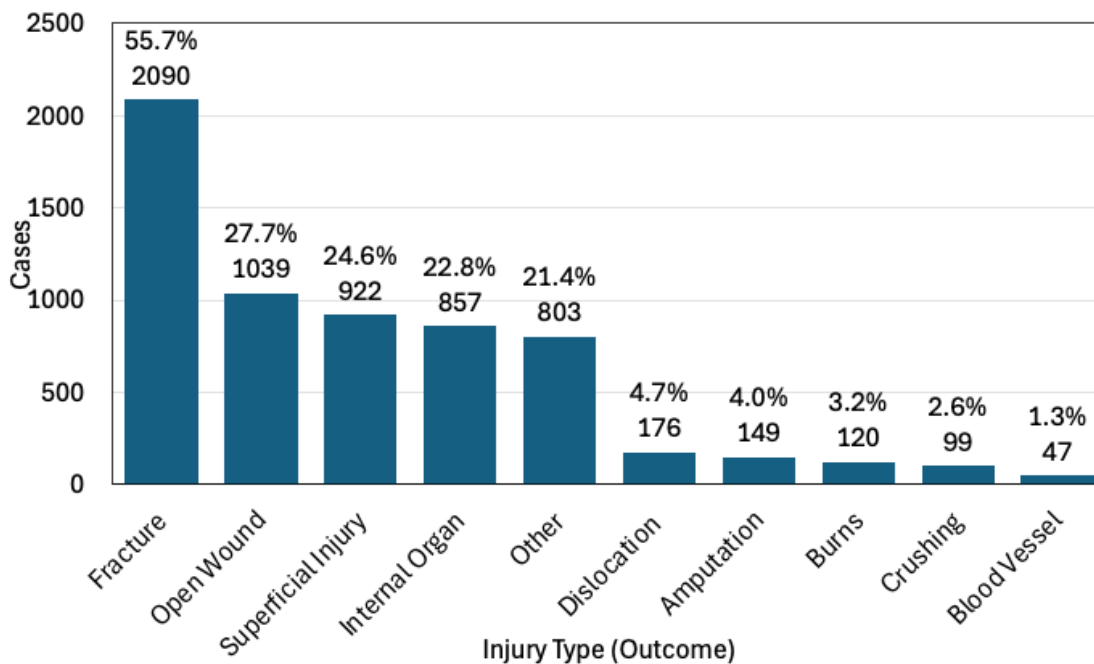


Figure 2: Injury Diagnosis for farm-related injuries, 2017 to 2023

Note: 6302 diagnoses were provided for 3753 injuries

Fall Cases

During 2017 to 2023, 949 farmers were injured due to a fall. Details on injury diagnoses resulting from a fall are provided in Figure 3. A fall could result in multiple injury diagnoses. Multiple injury diagnoses were identified for 433 (45.6%) of falls. The most common type of injury was a fracture (n=676, 71.2%).

Mechanisms by which a fall injury occurred are presented in Figure 4. While 50.8% (n=482) of falls were from elevated levels (ladder, stairs, structures, etc.), around 27.2% (n=258) were from slip/trip/stumbling resulting in a fall on the same level.

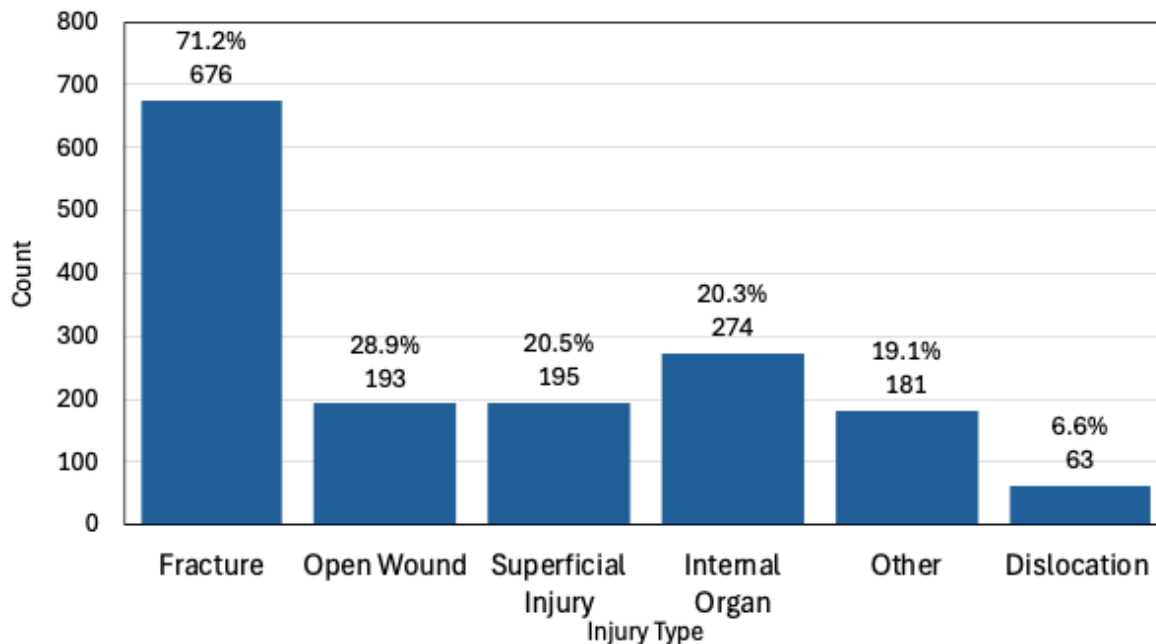


Figure 3: Fall-related injury diagnoses

Note: 1582 diagnoses for 949 injuries

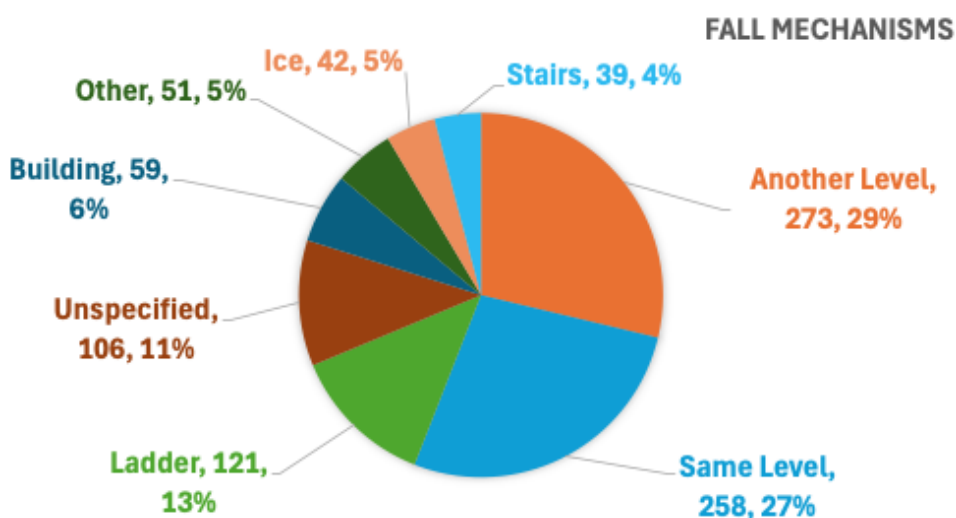


Figure 4: Distribution of fall mechanisms (n=949)

Interactions with Equipment Cases/Contact with Machinery

Interaction with equipment included cases that were “contact with machinery”, “struck by”, and “cut/pierce”. Aggregating across these categories, 939 (25.0%) of all farmers’ traumatic injuries were caused by equipment interactions. Most of these types of injuries were caused by contact with machinery (n=491) for which details about injury diagnosis (Figure 5) and injury source (Figure 6) are presented. The most common injury diagnosis was fracture (n=257, 52.3%).

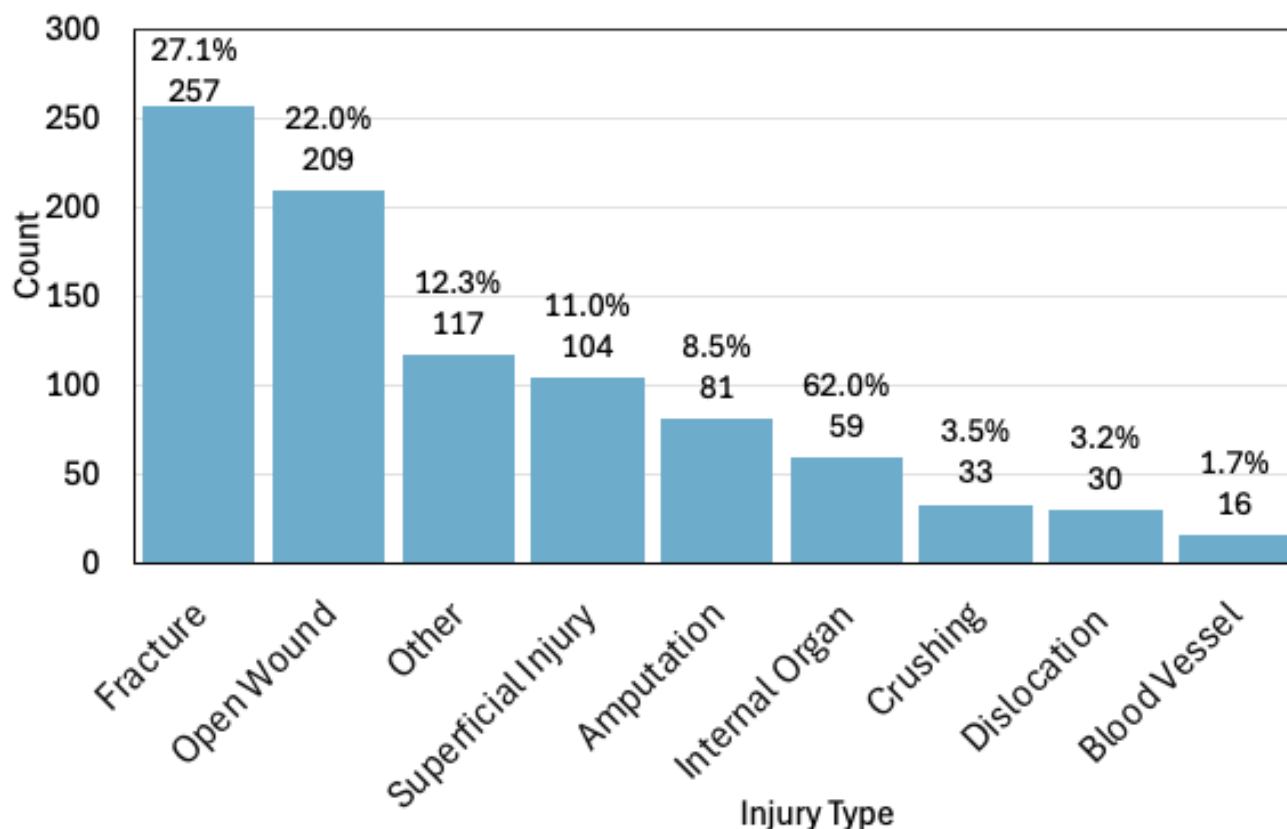


Figure 5: Contact with machinery injury diagnoses

Note: 906 diagnoses for 491 injuries

The ability to identify agricultural related sources of injury is limited to the specificity of the ICD10 coding system. The most identified source of farm-related injuries was Other Ag. Machinery, which includes all injuries where an agricultural source was specified but a specific ICD10 code does not exist for the specified source. Specific agriculture related codes exist for combine harvesters, power takeoff, and grain elevator. Non-agricultural related machinery sources were identified as causes of injury, but no specific sources had more than 10 events. Non-agricultural related machinery sources were grouped as Other and included: commercial machinery, metalworking, woodworking, prime movers, drilling, transmission devices, and unspecified machinery.

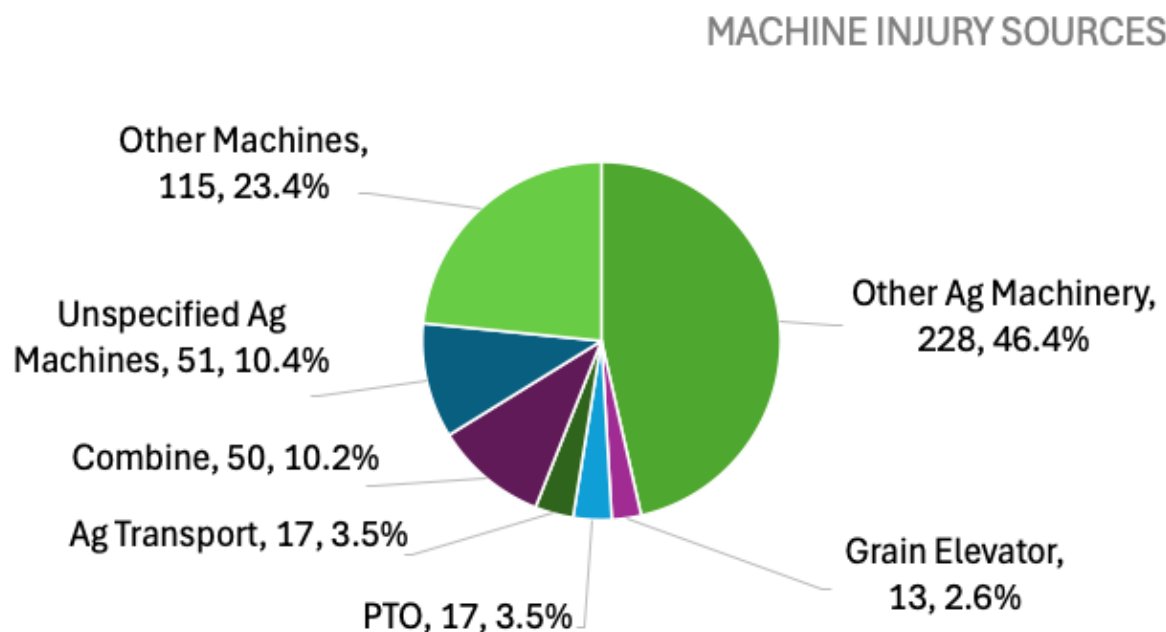


Figure 6: Distribution of contact with machinery sources (n=491)

Being struck by an object, 285 total injuries, was another way that interaction with machinery injuries occurred. Struck by object injuries did not commonly include a specified object, such as contact with a person or baseball. Instead, these injuries were reported in categories of other sources with the most frequent injury sources being struck by a thrown, projected, or falling object (n=124, 43.5%) and striking against objects (n=92, 32.3%).

Table 2: Cause Categories for 2017-2023 Iowa Trauma Registry “Struck By” injuries

Injury Mechanism	N	%
Other cause of strike by thrown, projected or falling object	124	43.5
Striking against or struck by other objects	92	32.3
Striking against other object with subsequent fall	13	4.6
Striking against other stationary object	13	4.6
Contact with blunt object, undetermined intent	12	4.2
All other struck by	31	10.9

Natural Injury Cause Cases

The ICD-9 category of “Natural and Environmental Factors” includes injuries caused by weather related exposures and contact with animals. For farmers in the trauma registry, most of the cases identified in this category were “animal caused injuries”. For these injuries, 50.9% resulted in fractures (Figure 7). The sources of injury are presented in Figure 8. “Contact with a cow” was the most common mechanism by which natural and environmental injuries occurred (n=377, 65.5%).

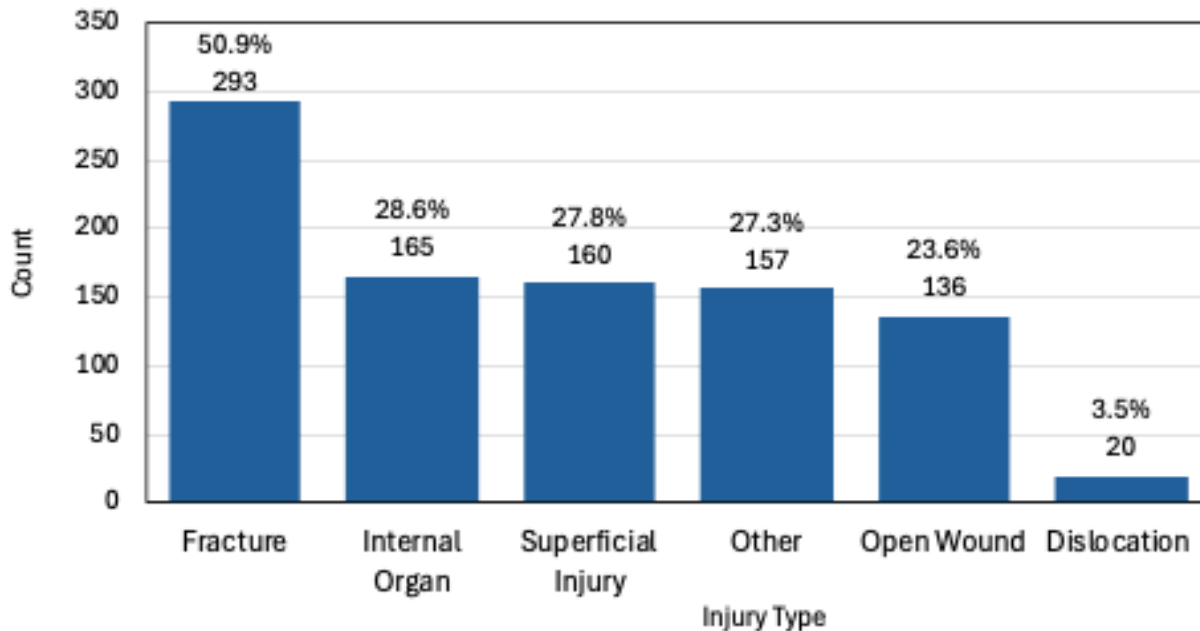


Figure 7: Natural and environmental injury diagnoses

Note: 931 diagnoses for 576 injuries

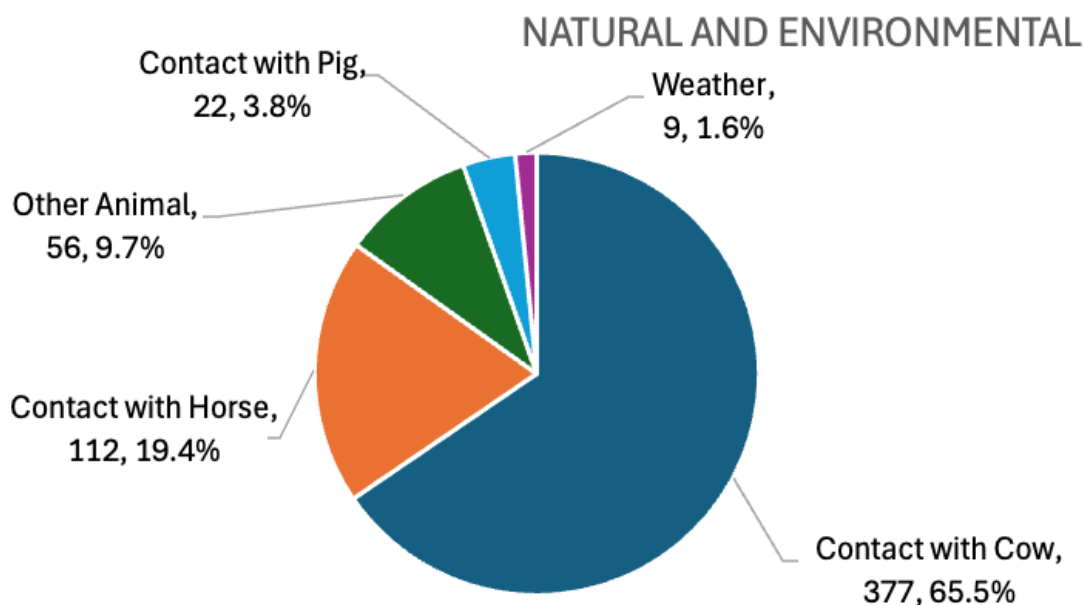


Figure 8: Distribution of sources for natural and environmental injuries (n=576)

Transportation Injury Cause Cases

There were 903 farm-related traumatic injuries due to transportation. Figure 9 illustrates the injury diagnoses for these injuries. Like other injuries, fractures were the most common type of injury identified for transportation injuries (n=593, 65.7%).

Figure 10 details the types of transportation injuries that occurred during 2017 to 2023. Injuries from being in a vehicle in traffic was the most common (23.0%) but several other non-traffic sources of injury were identified (18.8% riding an animal, 18.1% vehicle non-traffic, 16.2% agricultural vehicle not in traffic, 12.8% all-terrain vehicles (ATV) not in traffic). Taken together non-traffic sources of injury make up 595 (65.9%) of the transportation injuries.

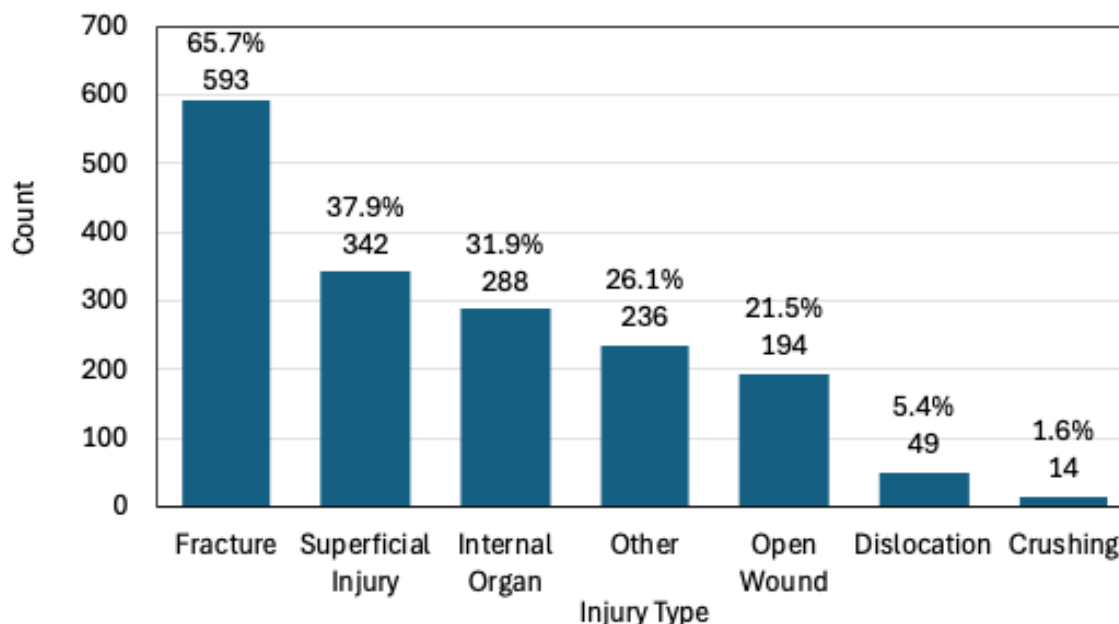


Figure 9: Transportation injury diagnoses

Note: 1716 diagnoses for 903 injuries

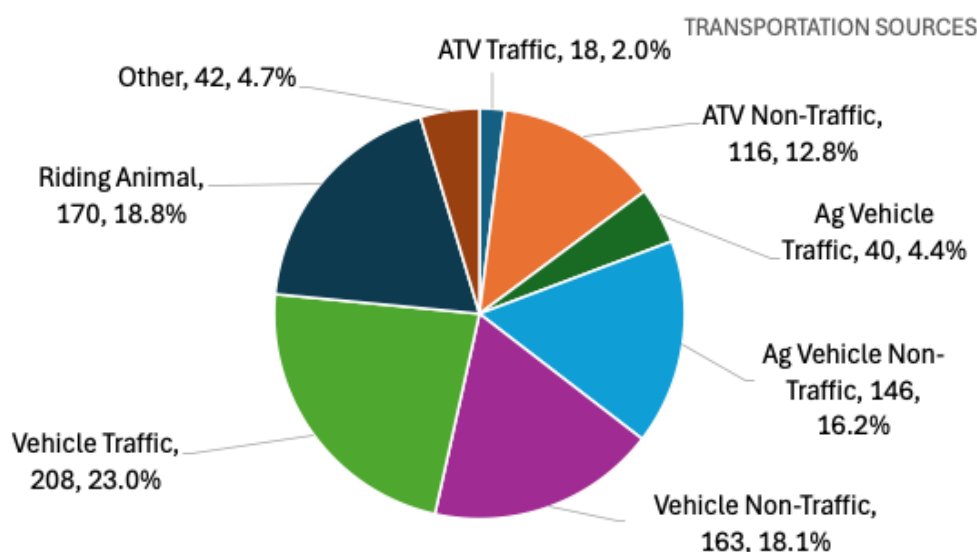


Figure 10: Distribution of injuries from transportation sources (n=903)

Body Region Injured

The distribution of where injuries occurred on the body, across all cases, is given in Table 11. Traumatic brain injuries are a serious injury were identified for 15.4% (n=578) of farm-related injuries. The most common body region injured was upper (n=1,301, 34.7%) and lower extremities (n=1,261, 33.6%). A similar proportion of injuries affected the head (n=1,132, 30.2%).

Table 3: Counts and frequency of body region injured

Body Region	Cases	Percent (%)
Traumatic Brain Injury	578	15.4
Head	1,132	30.2
Spinal Cord	38	1.0
Vertebral Column	514	13.7
Chest/Abdomen/Trunk	1,033	27.5
Pelvis	309	8.2
Upper Extremity	1,301	34.7
Lower Extremity	1,261	33.6
Multiple System	128	3.4
Other Body	448	11.9

Age and Injury Mechanism

Types of injury mechanism varied across age groups. Fall injuries made up an increasingly larger proportion of injuries from age 55 onward. For younger/middle aged workers, aged 25-44, the most common injury mechanism was interaction with equipment. No other age group had interaction with equipment as their most common injury. For the 55 to 64 age group motor vehicle and transportation injuries were the most common type of injury.

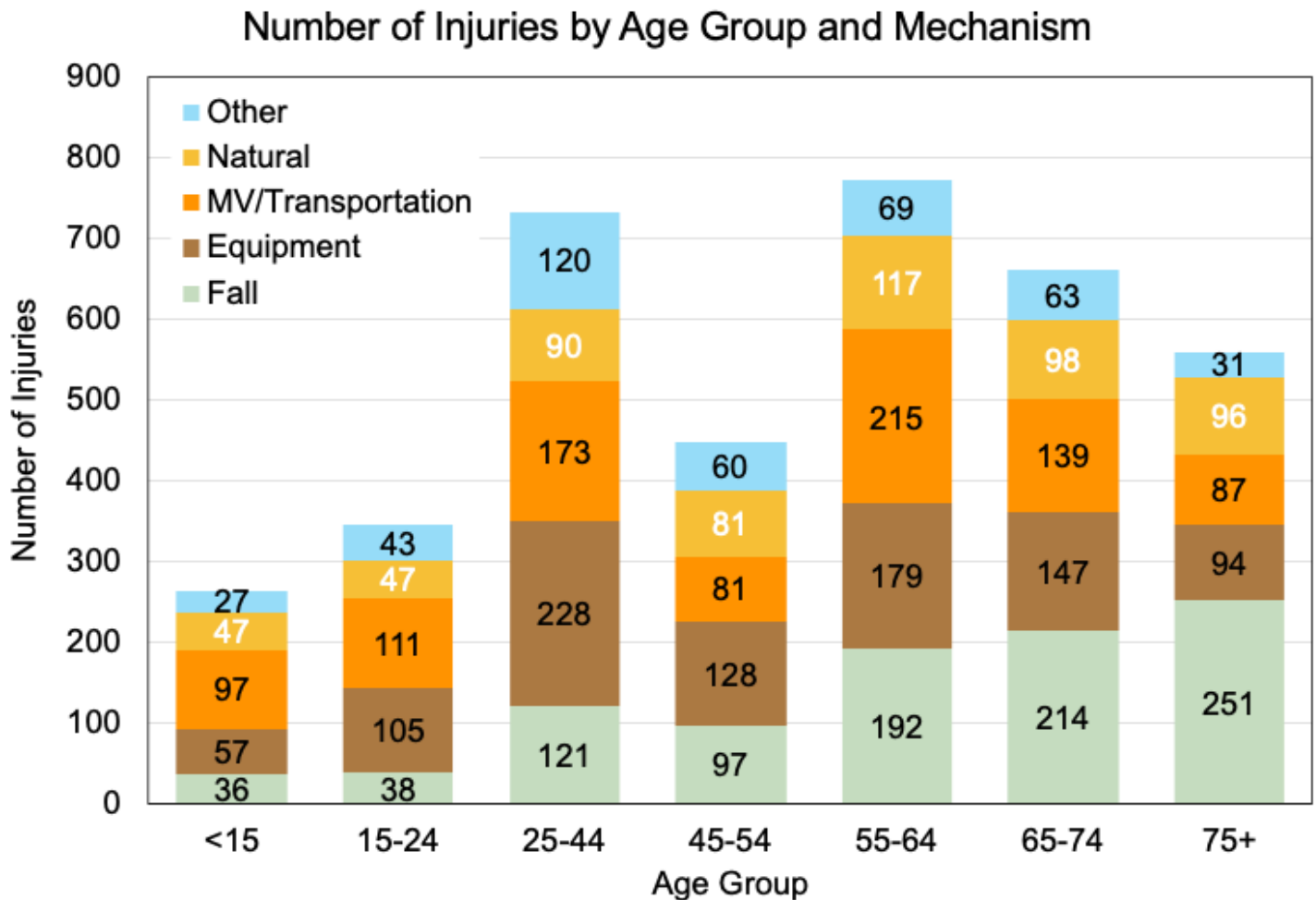


Figure 11: Injury mechanism across age groups

Abbreviations: MV=: Moter Vehicle

Note: 3885 diagnoses for 3752 injuries. Age missing for one injury that was excluded.

Summary

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

The box below provides a summary of the data intended to communicate risks to farmers and their safety and health advocates.

- ❑ **Falls** are the most common farm-related injury that results in farmers needing to seek care in the emergency room (136 per year).
 - Fractures were the most common traumatic injury diagnosis with 71% observed of traumatic injury falls resulting in a fracture.
 - About 40% of falls resulted in severe outcomes.
- ❑ **Contacting machines**, both agricultural and others, resulted in around 70 farm-related traumatic injuries per year.
 - Contact with machinery accounted for 47.6% of all farm-related amputations.
 - Over half of the injuries caused by machinery were caused by specified and unspecified agricultural machinery. This means a specific injury code did not exist for a machine source or the machine type was not recorded during treatment for many of the sources of farm-related injuries from contact with agricultural machinery.
 - PTOs accounted for only 3.5% of traumatic injuries associated with contacting equipment.
- ❑ **Animal injuries** cause nearly a quarter of farm-related injuries (81 farmers/year)
 - Half of injuries caused by animals/natural factors resulted in fractures.
 - Cows (65%) and horses (19%) are the *most frequent* cause.
 - Contact with pigs (4%) and other animals (10%) are also risks but cause fewer trips to the ER.
- ❑ **Transportation** risks account for 129 farm-related injuries per year -- These events are NOT just occurring on the road:
 - Transportation incidents occurring *off the road* made up *two thirds* of transportation related injuries.
 - Animal riding was involved in 19% of the transportation related traumatic injuries to farmers.

Have the Conversation about Injuries on the Farm

In Iowa between 2017-2023,
traumatic farm-related injuries resulted in 3753 ER visits.
(1.5 farmer ER visits / day)



Falls caused 1 in 4 injuries

949 Falls (22%)	Injuries
One level to another	273
Same level	258
Ladders*, scaffolding	121

FALLS

- 136 farmers/year go to the ER because of a fall
- ≥ 55 years old go to ER over **twice** as often as younger farmers
- Farmers who fall most often result in fracture (71%) or internal organ damage (29%)



Transportation was involved in 1 in 4 injuries

903 Transportation	Injuries
Animal Riders	170
Off-road Vehicles	134
Roadway Collisions	208
Ag Vehicle Off Road	146

TRANSPORTATION

- Of **all ER visits** with farmer injuries: transportation events **on the road** account for 7%, but **non-roadway** events account for 11%
- Of all injuries, 4% involve ATVs, 5% involve Ag vehicles, and 10% involve non-ag vehicles



Machine interactions caused 1 in 4 injuries

939 Interactions were:	Injuries
Contact with	491
Struck by/against	285
Cut/Pierce	163

ANIMAL INJURIES

- Injuries from **riding animals** account for 4.5% of ER trips
- Over **all ER trips** by farmers, the most animal contact injuries were from contact with:
 - **Cow (10%)**
 - **Horse (1.5%)**

AMPUTATIONS

Getting caught in/between moving equipment accounted for 54% of all on-farm amputations

Most Prominent Farmer Injuries: 2017-23

Outcomes



Fractures: 56%



Lacerations/Open Wounds: 28%



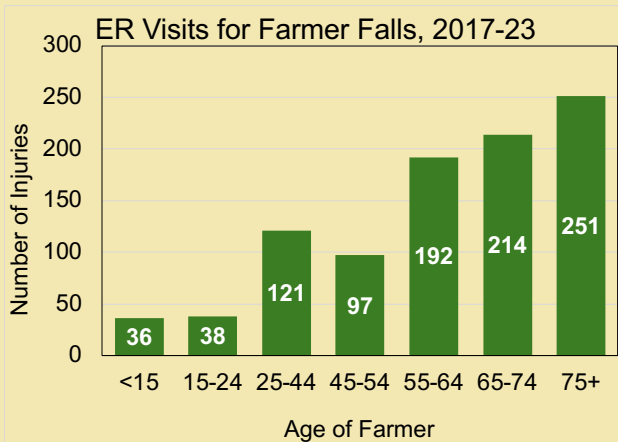
Internal Organ: 23%



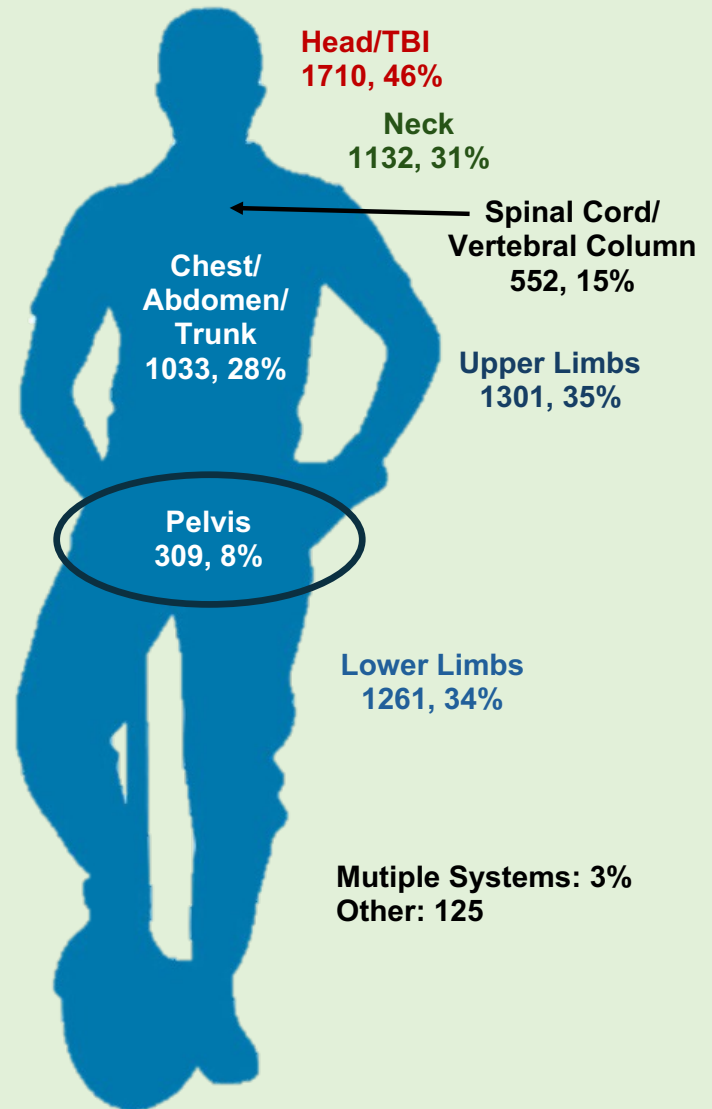
Amputations: 4%

AGE-RELATED INJURIES

69% of all falls resulting in ER trips are for those >55 YO



Body Part Injured



MULTIPLE DIAGNOSES

46% of injured farmers had more than one injury diagnosis

Example: with fracture (n=2090), it is common to *also* have superficial injury (bruise, 489) and open wound (laceration, 438)