Trends in Fatal Occupational Injuries in Selected Agricultural Industries

from the:
Midwest Region of the Census of Fatal Occupational Injuries 2005 - 2012

Amanda Swanton
Tracy Young, MS
Corinne Peek-Asa, PhD
Marizen Ramirez, PhD
Fred Gerr, MD, Director

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Introduction

Rationale for the Report

Background

Agriculture plays a vital role in society by providing both food products and raw materials for manufactured goods. However, agriculture is an industry with one of the highest fatality rates in the United States and poses particular risks to vulnerable populations such as elderly workers. Numerous hazards threaten farm workers including exposure to machinery, livestock, chemicals, noise, and physical stress, which can be compounded by the fact that agricultural activities are often performed in rural environments with limited access to medical services.

Though injury surveillance among agricultural workers has existed in the United States since the 1940s, the hazards associated with agriculture were brought to light in 1988 by the National Coalition for Agricultural Safety and Health (NCASH; Merchant et al., 1988). Their recommendations prompted increased national recognition and support for efforts to improve surveillance, increase research funding for agricultural safety and health, and implement prevention strategies. Since 1992, the Bureau of Labor Statistics (BLS) has collected data via the Census for Fatal Occupational Injuries (CFOI) to monitor the occurrence of work-related deaths (including those among agricultural workers) in the United States.

Anticipated Use

We envision that this report would be utilized for several purposes. First, these data can inform public health, healthcare, and agricultural safety practitioners and aid in the development and implementation of new prevention strategies. The description of the causes and types of injuries from agricultural fatalities, as well as the age distribution of those affected, may allow for more specifically targeted interventions that more effectively meet regional needs. Additionally, this data may serve as a baseline to evaluate new programs or be used in conjunction with other surveillance data to evaluate prior efforts to reduce agriculture-related fatalities.

Second, we hope to provide a tool for policy-makers to promote the recognition of the continued hazards associated with agricultural work and prompt legislative initiatives to improve agricultural safety. The consistently high fatality rates without evidence of a decline over the study period indicate that attention is still needed in this area.

Lastly, this report offers information regarding the current regional status of occupational fatalities in Midwestern agricultural workers that could be useful in an academic setting for educational purposes or as the basis for new research questions. Each figure is accompanied by bulleted speaking points to aid in the interpretation of these results and dissemination to a larger audience.

A PowerPoint presentation has been developed to augment this report. The PowerPoint presentation includes all of the figures in the report, as well as notes that speakers can use as a guide.

Methods

Study design and population

Census of Fatal Occupational Injuries (CFOI) data are collected by the Bureau of Labor Statistics (BLS) and contain information on fatal occupational injuries occurring in the U.S. To be included in CFOI, the decedent must have been employed at the time of the event, been engaged in a legal work activity, or been present at a site as a job requirement. Public- and private-sector non-institutionalized workers (i.e., wage and salary, self-employed, and volunteer) are included. CFOI excludes deaths that occurred during a worker's normal commute to and from work and deaths related to occupational illnesses (e.g., lung disease or cancer). Two source documents, such as, death certificates, workers’ compensation reports, news media, and other federal, state, and local government agency reports, and private sources are used to verify that the fatalities were work-related. When two sources are not available to confirm the circumstances of the fatality, one source document and a follow-up questionnaire are used to ensure that the fatal injuries are work-related.

Our study years ranged from 2005 through 2012 and included the CFOI Midwest region which includes:

- Iowa
- Illinois
- Indiana
- Kansas
- Michigan
- Minnesota
- Missouri
- North Dakota
- Nebraska
- Ohio
- South Dakota
- Wisconsin

Our data sample included agricultural fatalities only, and these were identified using North American Industry Classification System/NAICS codes: 111-Crop production, 112-Animal production, 1151-Support activities for crop production, and 1152-Support activities for animal production. Data were obtained from Excel files (tab-delimited data format) and imported into SAS statistical software. All data analyses were performed using SAS 9.3 (SAS Institute, Inc., Cary, NC, USA). Totals were calculated with restricted access to the CFOI research file. The views expressed here do not necessarily reflect the views of the BLS.

Variables

Variables examined in our study included age and gender; injury event information and other circumstances surrounding the injury incident; year of death; location of incident; date/time of incident; nature of injury; cause of injury; body part affected; source of injury; worker activity; and number of days from injury to death. Industry and geographic codes were used to obtain our study population. Age was grouped into five categories: < 16, 16-24, 2-44, 45-64, and 65+. Time of incident was categorized into five groups: 12am-5:59am, 6:00am-11:59am, 12:00pm-5:59pm, 6:00pm-11:59pm, and Not reported/NR. Number of days from injury to death was grouped into six categories: 0 days, 1 day, 2 days, 3-7 days, 8-14 days, and 15+ days.

Limitations

While the CFOI data is one of the most complete occupational injury surveillance systems in the United States, some limitations exist. First, obtaining the case-level data comes with some strict requirements from the BLS, which limits the nature of the variables that can be collected. Additionally, CFOI requires two methods of verification that the injury is work-related; cases not meeting this criterion are excluded from the database. As such, this report may underestimate the true mortality burden. Lastly, the data does not have personal identifiers of the deceased or the employer limiting the ability of risk assessment and appropriateness of preventative measures on an individual basis.
Agriculture-Related Fatalities 2005-2012, Counts and Rate Trends

Over the eight-year period from 2005-2012, no increasing or decreasing trends were exhibited in the number or rate of agriculture-related fatalities in the Midwest. Minor fluctuations were observed from year to year, but overall, both the number and rate remained relatively constant. The rate is measured as the number of agriculture-related fatalities per 100,000 farm operators.

- The number of agriculture-related deaths per year in the Midwest remained fairly stable from 2006-2010 with a decreasing trend occurring in 2011-2012.
- On average, there were 232 agriculture-related fatalities per year from 2005-2012.
• The rate of agriculture-related deaths per year remained fairly stable from 2005-2010 with a decrease in fatality rates in 2011-2012.
• For every 100,000 people in the Midwest, there was an average of 19.94 agriculture-related deaths per year from 2005-2012.
Agriculture-Related Fatality Incidence Differs by Age and Sex

The number of agriculture-related fatalities increases with age and the highest number of fatalities occur among those aged 65 and older. The increased number among older workers may be due to either a higher rate of fatal injury among older workers, a greater proportion of all workers being older, or perhaps both. Additionally, agriculture-related fatality is much more commonly experienced by males than females.

- The greatest number of agriculture-related fatalities occurred in older adults with 41% of deaths occurring in adults age 65 and older.
- Over three-quarters (77%) of the agriculture-related deaths occurred among persons 45 years or older.
- Less than 3% of agriculture-related fatalities occurred among minors less than 16 years old.

Source: Fatal occupational injury data were generated by the Great Plains Center for Agricultural Health with restricted access to BLS CFOI microdata (2005-2012), Midwest Region
• The highest rate of agriculture-related fatalities occurred in the young (yet only comprised 9% of the deaths) followed by persons aged 65 and older, which comprised the largest proportion of fatalities (41%).

![Pie chart showing fatalities by age and gender.](image)

- Persons experiencing agriculture-related fatality are much more likely to be male than female. Of the 1858 agriculture-related deaths in the Midwest, the majority (94%) of them occurred in males, while only 4% occurred in females.
- For every agriculture-related death in a female, there were 17 agriculture-related deaths in males.

Source: Fatal occupational injury data were generated by the Great Plains Center for Agricultural Health with restricted access to BLS CFOI microdata (2005-2012), Midwest Region
Agriculture-related fatalities are most frequent from late spring to early fall and result from incidents that occur during the day time hours on farms.

- The frequency of agriculture-related fatalities was lowest in the winter, rose during the spring, peaked during the summer, and declined again in the fall. This trend may correspond to increase in farming activities during non-winter months.
- The greatest number of deaths occurred in July (13%), while the lowest number of deaths occurred in December (4%).
71% of the agriculture related deaths occurred during the morning/afternoon (6:00am – 5:59pm), compared to only 18% of deaths that occurred during the evening/night (6:00pm-5:59am). Deaths most frequently occurred (47%) during the afternoon and evening, 12:00-5:59pm, which appears to coincide with workday activity.

Agriculture-related fatalities were least likely to occur in the early morning between 12:00am -5:59pm.

For 208 (11%) of the documented fatalities, no time was reported for the agriculture-related incident.

The largest proportion of fatalities occurred on the farm (80%). An additional 15% occurred on a street or highway.

Approximately 5% of all agriculture-related fatalities occurred in the home, an industrial environment, or another place.
Agriculture-Related Fatalities by Activity and Source of Injury

The most frequent activity at the time of the incident was Vehicle and Transportation operations; this was consistent across all age groups. The vehicles themselves were the most common source of the injuries leading to agriculture-related fatalities.

More than half (51.6%) of the individuals who died due to an agriculture-related injury from 2005-2012 were performing a vehicle- or transportation-related task at the time of the incident. Of these 958 fatalities, 315, or 33%, were due to farm vehicle (e.g. tractor) rollovers.

The second most common activity at the time of the injury was construction, repair, and cleaning tasks, which accounted for 18% of fatalities.

The third most common activity at the time of the injury was tools/machinery which accounted for 10% of fatalities.

Materials handling (7%), other (6.5%--of which 106/120 or 88% were due to animal care/tending activities and 67/106 were due to assaults by animals), physical activities (3%), and protective service activities (<1%) were less common activities at the time of injury.

For 4% of cases, the activity at the time of injury was not reported.

SOURCE: Fatal occupational injury data were generated by the Great Plains Center for Agricultural Health with restricted access to BLS CFOI microdata (2005-2012), Midwest Region
CFOI measures the activity and source of injury. Injury activity indicates what the worker was doing at the time of the injury. The source identifies the object, substance, bodily motion or exposure that directly produced or inflicted the previously identified injury.

- Vehicle or transportation-related tasks were the most common activity at the time of the fatal injury incident across all age groups.
- Construction, repair, and cleaning tasks were the second most common activity at the time of fatal injury for individuals age 16 and older.
- Materials and handling tasks was the second most common activity for individuals less than age 16.
- Tools and machinery-related tasks was the third most common activity for those over age 25.
- The third most common activity for individuals age 16-24 was materials handling tasks.

**Agriculture-Related Occupational Fatalities in Twelve Midwestern States By Age and Activity**

* No data or data that do not meet BLS publication criteria

**SOURCE:** Fatal occupational injury data were generated by the Great Plains Center for Agricultural Health with restricted access to BLS CFOI microdata (2005-2012), Midwest Region

\[ \text{p}=0.064 \]
• Vehicular injury was the most common primary source of fatality accounting for 55% of deaths.
• The second and third most common sources of fatal injury were machinery (15%) and persons/plants/animals/minerals (11%).
• Less than 19% of deaths fell into each of the remaining categories: structure/surfaces, other sources, parts/materials, containers/furniture/fixtures, chemicals/chemical products, and tool/instruments/equipment.

SOURCE: Fatal occupational injury data were generated by the Great Plains Center for Agricultural Health with restricted access to BLS CFOI microdata (2005-2012), Midwest Region
Most agriculture-related fatalities resulted from transportation-related injuries; this was consistent across all age groups.

- Transportation-related causes of injury accounted for 49% of all agriculture-related deaths (of which 315/913 or 34.5% were due to farm vehicle rollovers). After transportation-related, contact with objects or equipment accounted for another 32% of agriculture-related fatalities.
- Less than 20% of cases involved: assaults/violent activities, falls, harmful substances/environmental exposures, and fires/explosions.

**Agriculture-Related Occupational Fatalities in Twelve Midwestern States By Cause of Injury**

<table>
<thead>
<tr>
<th>Cause of Injury</th>
<th># Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation-related</td>
<td>913</td>
</tr>
<tr>
<td>Contact with objects/equipment</td>
<td>586</td>
</tr>
<tr>
<td>Assaults/Violent activities</td>
<td>122</td>
</tr>
<tr>
<td>Falls</td>
<td>108</td>
</tr>
<tr>
<td>Harmful substances/Environment exposures</td>
<td>87</td>
</tr>
<tr>
<td>Fires/Explosions</td>
<td>41</td>
</tr>
</tbody>
</table>

**SOURCE:** Fatal occupational injury data were generated by the Great Plains Center for Agricultural Health with restricted access to BLS CFOI microdata (2005-2012), Midwest Region
The most common cause of agriculture-related fatality in the Midwest was transportation-related events, followed by contact with objects or equipment. This was consistent within each age group.

The third most common cause of injury varied by age. For individuals age 65 and older, the third most common cause of fatality was falls, though assaults and violent activities were nearly as prevalent. For individuals between the ages of 45-64, assaults/violent activities was the third most common cause of injury. For individuals in the 25-44 and 16-24 age groups, harmful substances/environmental exposures was the third most common cause of injury.

In general, numbers of injury occurrences in a particular category tended to increase with age. An exception to this trend was fatalities due to harmful substances/environmental exposures which peaked in the 45-64 category and declined in the 65 and older category.

For those 25 and older, the number of fatalities from fires and explosions increased with age.
Most agriculture-related injuries were the result of “other” injuries that did not fall into the following categories: multiple injuries, intracranial injuries, bone/nerve/spinal cord injuries, open wounds, and burns; This observation was consistent across all age groups, but not across all causes of injury. Of the classes listed, multiple injuries caused the most agriculture-related fatalities in all age groups except among those less than 16 year of age; multiple injuries were less common for certain causes of injury. Most fatal injuries were most commonly to the trunk or multiple body parts.

For 29% of those experiencing a fatality, the nature of the injury was recorded as multiple injuries followed closely by internal organ/blood vessel (26%).

An additional 16% of deaths resulted from intracranial injuries as well as asphyxiation.

Less than 14% of injuries were due to other injuries (6%), bone/nerve/spinal cord injuries (3%), open wounds (3%), and burns (2%).
Multiple injuries was the most common type of injury accounting for 29% of agriculture-related deaths overall followed by internal organ/blood vessel injuries (25%).

The most common type of injury among those < 16 years of age was intracranial injuries (29%) followed closely by asphyxiation (25%); among those aged 16-24 was multiple injuries (30%) and intracranial injuries (24%), 25-44 was multiple injuries (32%) and asphyxiation (19%); among those aged 45-64 was internal organ/blood vessel injuries (28%) followed by multiple injuries (27%), and for those aged 65 and over, multiple injuries (30%) and internal organ/blood vessel injuries (29%).

The third most common type of injury among those < 16 was internal organ/blood vessel injuries (22%); among those 16-24 was asphyxiation which accounted for 15% of fatalities; among those 25-44 years of age was internal organ/blood vessel injuries (15%); among those aged 45-64 was asphyxiation (15.6%) and intracranial injuries (15.3%); and for those aged 65 and over was intracranial injuries (16%).
Among the top three causes of injury (transportation-related, contacts with objects or equipment, and assaults/violent attacks), the most common types of injuries were internal organ/blood vessel injuries, multiple injuries, intracranial injuries, and asphyxiation.

Deaths due to open wounds were most commonly caused by assault/violent attack (52%) or contact with objects or equipment (36%); together these causes accounted for 88% of the deaths due to open wounds. The remaining 10% of deaths due to open wounds were the result of transportation-related incidents or fall incidents.

Deaths due to bone/nerve/spinal cord injuries were most commonly caused by transportation-related incidents (44%), contacts with objects or equipment (28%), or falls (26%).

The most common type of fatal injury among those experiencing a fall was intracranial injuries (42%). Other types of common fatal injuries among those experiencing a fall were multiple injuries (24%), bone/nerve/spinal cord injuries (13%), and internal organ/blood vessel injuries (12%).

87% of the deaths resulting from harmful substance or environmental exposures were caused by other injuries (at least some of these “other injuries” were likely poisonings) followed by environmental effects (10%).

* No data or data that do not meet BLS publication criteria

SOURCE: Fatal occupational injury data were generated by the Great Plains Center for Agricultural Health with restricted access to BLS CFOI microdata (2005-2012), Midwest Region

p<0.0001
Among agriculture-related fatalities, death most commonly occurred due to injury to multiple body parts (30%), the trunk (29%), body systems (20%), or the head (17%).

Neck, lower extremity, and upper extremity injuries combined accounted for only 4% of agriculture-related fatalities.

SOURCE: Fatal occupational injury data were generated by the Great Plains Center for Agricultural Health with restricted access to BLS CFOI microdata (2005-2012), Midwest Region
Agriculture-Related Fatalities by Length of Survival

Most agriculture-related deaths occurred within one day of the injury; this was consistent across all age groups. A greater number of later deaths occurred among older age groups.

Of the individuals experiencing an agriculture-related death, most died relatively soon after the inciting injury. Of the agriculture-related fatalities, 86% occurred within the first 24 hours, 93% within the first 48 hours, and 95% within the first week.

Only 3% of individuals experiencing an agriculture-related fatality died of their injuries more than two weeks after the incident.
For all age groups, most agriculture-related fatalities occurred within the first 24 hours of the injury.

As age increased, both the crude number of deaths and the number of deaths that occur a longer period after the injury also increased.

- For adults above 45 years and older, 6% of the deaths occurred between 24-48 hours after injury. Of the 130 deaths from all ages occurring between 24-48 hours, 48% were in adults age 65 and older, and 79% of deaths were in adults age 45 and older.

- Older adults accounted for the majority of deaths that occurred greater than two weeks after the injury; the proportion of these deaths also increased with age. Of the 61 deaths occurring more than two weeks after the injury, 59% were adults age 65 and older, and 90% were adults age 45 and older.
Conclusions

In conclusion, agriculture-related fatality continued to be a problem in the Midwest. These data showed that certain segments of the population, particularly individuals who were male or elderly, exhibited a higher frequency of fatalities. However, the highest rate of agriculture-related fatalities occurred in the young (i.e., persons less than 25 years old yet only comprised 9% of fatalities) followed by persons aged 65 and older (41% of fatalities). As one might expect, most fatalities took place on farms during working hours in months when agricultural workers are most active and were most commonly the result of transportation-related injuries. Most fatalities were caused by injury to multiple body parts, followed closely by injury to the trunk. Additionally, though fatalities most often occurred within 24 hours of the inciting injury, deaths occurring after 24 hours were more frequent with increasing age. The fact that some older individuals do not die immediately of their injuries suggests that there may be an opportunity for medical intervention to potentially save these lives, however further research to characterize the circumstances of these later-occurring fatalities is needed.
References