Injuries Among Farm Workers in the United States, 1993

John R. Myers
Division of Safety Research

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Executive Summary

The Traumatic Injury Surveillance of Farmers (TISF) survey project is the first national surveillance project in over 15 years to provide injury data for the entire agricultural production industry (i.e., farms). These data provide sufficient detail to target both specific farm types and farm workers at high risk of work injuries. This document summarizes nonfatal lost-time work injury estimates for the agricultural production industry for 1993.

Major findings from the 1993 TISF include:

- An estimated total of 201,081 lost-time work injuries occurred on U.S.farms in 1993. This represents an incidence rate for all farming operations of 6.5 injuries/200,000 hours worked (200,000 hours is equivalent to 100 full-time workers).

- The highest injury rates were associated with specialty livestock operations, such as horse farms and fur farms (12 injuries/200,000 hours worked), followed by beef, hog, or sheep operations (8.2 injuries/200,000 hours worked), miscellaneous farming operations (7.9 injuries/200,000 hours worked), and nursery operations (7.3 injuries/200,000 hours worked).

- The greatest number of injuries were in beef, hog, or sheep operations (31.1%), followed by dairy operations (18.5%), vegetable, fruit, or nut operations (16.2%) and cash grain operations (14.5%).

- The leading causes of lost-time work injuries on farms were livestock (18.1%), machinery, excluding farm tractors (17.2%), and hand tools (11.4%). Farm tractors accounted for 5.5% of these nonfatal injuries.

- The injuries typically occurred to the workers' leg, knee, or hip (15.2%), back (15.0%), finger (12.1%), or their hands or wrist (11.8%).

- Sprains and strains (25.6%) accounted for the largest number of lost-time injuries, followed by lacerations (18.7%), fractures (15.2%), and bruises (13.8%).

- Farm operators and their family members accounted for most of the injuries (62.9%) reported in the TISF.

- Injured workers were usually male (90.3%), and the race or ethnic origin of the worker was typically white (76.2%). Hispanics accounted for the second highest number of injuries (21.8%).

- Of the estimated 126,700 injured family workers, 97 percent were white, with 43 percent of the injured family members working on beef, hog, or sheep operations. The estimated injury rate for family workers on all farms was 7 injuries/200,000 hours.

- Of the estimated 72,600 estimated injuries among hired workers, Hispanics accounted for 56 percent, with 32 percent of the injured hired workers working on vegetable, fruit, or nut operations (23,500 injuries). The injury rate for hired workers on all farms was 5.5 injuries/200,000 hours.

The tables of farm injury statistics contained in this document are designed as a resource for safety and health professionals and researchers to answer the major questions ask about farm-related work injuries. Farm injury statistics for 1993 are provided for the Nation, major regions, and selected States. The content of this document fills a critical information gap by providing detailed data on agricultural injuries in the U.S.

Section I: The Traumatic Injury Surveillance of Farmers Survey

INTRODUCTION

Workers in the agriculture industry of the United States (U.S.) have received a great deal of attention recently because of their high risk of fatal injuries and suspected risk for serious nonfatal injuries [NIOSH, 1992; Merchant et al., 1989]. A major problem with planning injury prevention programs for these agricultural workers is a lack of surveillance data, especially for those injuries which are nonfatal. To address this lack of nonfatal injury data, the National Institute for Occupational Safety and Health (NIOSH), working in cooperation with the National Safety Council (NSC) Agricultural Division and the U.S. Department of Agriculture (USDA), developed the Traumatic Injury Surveillance of Farmers (TISF) survey.

The objective of the TISF is to determine the frequency, incidence rate, and characteristics of agricultural work-related injuries occurring in the U.S. using a uniform surveillance system. This is accomplished by collecting data on agricultural work-related injuries that occur during a calendar year on a random sample of farms across the U.S. The TISF provides injury estimates at the State, regional, and U.S. level, and allows every state to obtain injury data within a 3-year time period.

The intent of the following document is to present the first year of TISF results in an easily accessible statistical abstract format. This is the first in a series of TISF reports that will eventually provide data for all 50 states. No attempt is made to interpret the results presented here because of the quantity of data presented. It is hoped that the data will be used by public health and safety professionals, engineers, and other groups working in the area of farm safety to help in their intervention programs and injury control research.

These data were collected by the USDA, National Agricultural Statistics Service (NASS) through an Interagency Agreement with NIOSH. The injury estimates and incidence rates presented in this statistical abstract were calculated by NIOSH and are presented here with the approval of USDA, NASS. Access to all TISF data files, or additional injury estimates from the TISF data, are subject to the approval of USDA, NASS.

METHODS

General Survey Design:

The TISF surveillance system is a mail survey-based surveillance system using a Total Design Method methodology (Dillman, 1978).

The TISF survey uses a personalized letter to the person asked to complete the survey, emphasizing that their response is important. Each person is sent a postcard after the first mailing of the survey reminding them to complete the questionnaire. Approximately 3 to 4 weeks after the initial mailing, a second letter and copy of the survey is sent to those people who have not responded. To increase the response rates, the TISF survey is conducted in January and February — a time of the year when most farm operators are not actively farming. The survey instrument used for the TISF is kept at a maximum of four pages. The 1994 instrument is provided in Appendix A. Finally, an abbreviated telephone survey is conducted on a random sample of 1,000 nonresponding farm operators to allow for the assessment of nonresponse bias in the main survey.

The sample selection and sampling frame information for the survey is provided by USDA, NASS through an interagency agreement. All agricultural production operations in the U.S. are in the population for study. NASS draws all samples, conducts the mailings, cnducts follow-back contacts to the farm operations for assessing nonresponse, enters data, and providing all sampling frame information required by the NIOSH sampling design.

For the survey, an injury is defined as any condition that results in ½ day or more of restricted activity (e.g., person could not perform work or other normal duties, missed work, missed school). An agricultural work-related injury is defined as any injury meeting this definition that occurred while performing work, either on the farm or off the farm, associated with the farm business. This definition excludes injuries to contractors working for the farm operation, injuries associated with work not done for the farm business, or injuries occurring on the farmstead while the person was not working for the farm business. While the total number of work-related lost-time injuries are requested for the calendar year on the survey, descriptive information is only provided for the most recent injury event.

All information provided on the survey is self-reported by the farm operator. As such, variables such as race or ethnic origin, age, and the cause of the injury event are subject to the interpretation of the farm operator.

Sampling Design:

A two-stage random sample of farm operations is drawn to provide estimates for the study population. The sample-based estimators for this two-stage design are provided in Appendix B. The first-stage consists of 42 primary units, which are individual states, or combinations of states, that ensure a reasonable number of farming operations per primary unit (Table 1-1). The primary units are stratified by geographic region in the U.S. (Table 1-2). Selection of these units is systematic within a region. The stratification of the first-stage sample by region reduces the effect of using systematic rather than random sampling. Equal probability sampling assumptions are used for the first-stage sample. The number of samples in the first-stage (n_1) ranges from

4

Table 1-1. Primary (States) and secondary (Farms) sample units
for the TISF Surveillance System.

Primary Units (States)	Secondary Units (Farms)
Alabama	47,000
Alaska, Washington	44,000
Arizona	8,100
Arkansas	48,000
California	84,000
Colorado	27,000
Connecticut, Rhode Island, Massachusetts	11,670
Delaware, Maryland	18,600
Florida	41,000
Georgia	48,000
Hawaii	4,650
Idaho	22,100
Illinois	83,000
Indiana	71,000
Iowa	105,000
Louisiana	34,000
Kansas	69,000
Kentucky	95,000
Maine, New Hampshire, Vermont	16,800
Michigan	55,000
Minnesota	90,000
Mississippi	41,000
Missouri	109,000
Montana, Wyoming	33,600
Nebraska	57,000
Nevada, Utah	15,500
New Jersey	8,300
New Mexico	14,000
New York	39,000
North Carolina	65,000
North Dakota	33,500
Ohio	86,000
Oklahoma	70,000
Oregon	37,000
Pennsylvania	54,000
South Carolina	25,500
South Dakota	35,000
Tennessee	91,000
Texas	186,000
Virginia	47,000
West Virginia	21,000
Wisconsin	81,000

Table 1-2. Geographic regions of the United States used in the TISF survey.

Region	States	Scheduled Survey Year(s)
Northeast	Maine	1994
	Vermont	1994
	New Hampshire	1994
	Massachusetts	1995, 1996
	Connecticut	1995, 1996
	Rhode Island	1995, 1996
	New York	1995
	Pennsylvania	1994, 1996
	New Jersey	1994
South	Delaware	1996
	Maryland	1996
	West Virginia	1995
	Kentucky	1995
	Virginia	1994, 1996
	Tennessee	1994
	North Carolina	1994
	South Carolina	1995
	Georgia	1995
	Florida	1994, 1996
	Alabama	1995
	Mississippi	1996
	Louisiana	1996
	Arkansas	1996
	Oklahoma	1994
	Texas	1996
Midwest	Ohio	1996
	Michigan	1994
	Indiana	1995
	Illinois	1995
	Wisconsin	1994
	Minnesota	1996
	Iowa	1994
	Missouri	1994, 1995
	Kansas	1994, 1996
	Nebraska	1996
	South Dakota	1995
	North Dakota	1994
West	Montana	1995
	Wyoming	1995
	Colorado	1994
	New Mexico	1996
	Arizona	1994
	Nevada	1995
	Utah	1995
	Idaho	1995
	Washington	1994
	Oregon	1995
	California	1994, 1996
	Alaska	1994
	Hawaii	1996

15 to 19 depending on the year of the survey. The second-stage sample is a stratified simple random sample of farming operations (i.e., secondary units) within the selected first-stage units. The second-stage stratification is by type of farming operation. Sample size allocations within strata are proportionally allocated by farm type. The total number of farms in each primary unit are given in Table 1-1. All responses to the mail survey are on a "per farm" basis. The second-stage sample size (n_2) is 1,400 farms per first-stage sampling unit.

Upon completion of the mail survey, a random sample of 1,000 nonrespondents from all primary units are contacted by telephone to obtain basic survey information which is used to assess nonresponse bias in the mail survey.

Injury, Restricted Workday, and Exposure Estimates:

The national and regional estimates and variances for injuries, restricted workdays, and hours of exposure are obtained by using the unbiased estimators of a two-stage sample, which are presented in Appendix B. The State estimates for injuries and hours of exposure are obtained using the unbiased estimator for a stratified simple random sample (Appendix B.). All sample-based estimators and variance estimators are derived from Cochran [1977].

Incidence Rate Estimates:

The injury incidence rates and the restricted workday incidence rates are estimated as the estimated injuries or restricted workdays at the State, regional, or national level divided by the estimated exposure at the State, regional, or national level respectively. The rates are then expressed in terms of 200,000 hours, which is the Bureau of Labor Statistics definition of 100 full-time workers [BLS, 1990].

The sampling variance calculations for the exposure-based incident rates are estimated using the linear combination of variances of the injury frequency estimate and the exposure estimate as described by Cochran [1977]. The general form of the variance expression is:

$$v(R) = 200,000^2 \ (\frac{1}{\overline{x}})^2 [v(y) + R^2 v(x) - 2R \ cov(y,x)]$$

where: $v(R)$ = variance of the rate, R;
          $v(y)$ = variance for the numerator (e.g., injuries);
          $v(x)$ = variance for the hours of exposure;
          $cov(y,x)$ = covariance between the numerator and the
                    hours of exposure;
          $\overline{x}$ = mean for hours of exposure.

The covariance term for the State estimate accounts for the stratification of the sampled farms, while the covariance term for the regional rates includes the first-stage and second-stage components of the covariance term. For the national estimates, only the first-stage covariance term is assessed with the second-stage component assumed to be negligible.

Categorical Frequency Estimates:

The frequency estimates for the categorical variables on the TISF survey are based on all farms that reported only one injury, excluding farms with more than one injury. This is done to avoid bias during the construction of frequency distributions of categorical variables. Because the TISF survey only has detailed information for the most recent injury event, including farms that reported more than one injury would bias the distributions by causing the distribution of injuries by month to be artificially skewed towards the later months of the calendar year. Furthermore, if different types of injuries are associated with the time of the year, then including injury descriptions for farms with more than one injury could bias other categorical variables.

The frequency estimates for farms with only one injury are adjusted for each stratum within a specific State to provide frequency results that sum to the estimated total injuries within each State. Because the regional and national estimates are derived from the State estimates, no further adjustments are required beyond the State level. The adjustment is a simple proportional increase of the sampling weight to make all farms with one reported injury account for the additional injuries not included for farms with more than one injury. For example, if the total estimated number of injuries for stratum A was 100 injuries, but the estimated number accounted for by farms reporting only one injury event was 85 for that stratum, then the sampling weight for the farms reporting only one injury event in stratum A would be increased by a factor of 1.18 (e.g. 100 divided by 85). This adjusted sampling weight is used to construct the categorical frequency tables.

Frequency tables for States, regions, and the nation are presented at differing levels of detail because of differing levels of data available at the three levels. National frequency tables provide the highest level of detail and cross classification of information, while the State data are only provided at the univariate level. The regional tables provide much of the same detail as the national tables, except for age-specific data, and the use of broad farming groups (crops and livestock) rather than the specific farm types presented in the national tables.

HIGHLIGHT OF RESULTS

A total of 12,990 of the sampled 25,200 farm operations responded to the mail survey for a response rate of 51.5 percent. The response rates by geographic region were essentially the same, ranging from a high of 53 percent in the South region to a low of

50 percent in the Northeast region. The survey response rate by State ranged from a high of 63 percent for the State of Virginia to a low of 42 percent for the State of North Dakota. Evaluation of the survey of 1,000 nonresponding farm operations from the main survey did not show any significant bias in the main survey associated with the nonresponding farms.

There were an estimated 201,000 ± 45,000 lost-time work injuries on farms in 1993. This represented an incidence rate of 6.5 ± 0.8 lost-time injuries per 200,000 hours of farm work. These injuries resulted in an estimated 3,0597,531 restricted workdays, with a corresponding lost workday rate of 98.3 lost workdays per 200,000 hours of work.

The region of the nation with the highest number of lost-time injuries was the Midwest with an estimated 82,900 lost-time injuries. The highest estimated injury rate also occurred in the Midwest (7.6 lost-time injuries per 200,000 hours of farm work).

The major sources of injury on U.S. farming operations were livestock (18.1%), machinery (17.4%), and hand tools (11.4%). These injuries most frequently resulted in a sprain or strain (25.6%), cut (18.7%), or fracture (15.2%). The body parts most commonly injured were the leg, knee, or hip (15.2%), the back (15.0%), and the finger (12.1%). Workers 30 to 39 years of age reported the highest number of these injuries (24.8%). Males were involved in these injury events 95 percent of the time.

Beef, hog, or sheep operations were found to have the highest number of lost-time work injuries (62,546 injuries) and restricted workdays (1,145,330 restricted workdays). Dairy operations had the second highest number of injuries (37,123 injuries); followed by vegetable, fruit, or nut operations (32,579 injuries);and cash grain operations (29,087 injuries). Vegetable, fruit, or nut operations had the second highest number of restricted workdays (553,842 restricted workdays); followed by cash grains (479,260 restricted workdays); and dairy operations (446,798 restricted workdays). The highest injury rates per 200,000 hours of work were seen in the combined group of other livestock and other farms (9.9 injuries per 200,000 hours); followed by beef, hog, or sheep operations (8.2 injuries/200,000 hours); nursery operations (7.3 injuries/200,000 hours); and dairy operations (6.4 injuries/200,000 hours).

Family workers (including partners and family members of the partner) accounted for more injuries(126,289 injuries), more restricted workdays (2,129,200 restricted workdays) and a higher injury rate (7.0 injuries/200,000 hours) than hired workers (Table 2-2). However, nursery operations, dairy operations, and the combined group of other livestock and other farms did have hired injury rates higher than family member injury rates (Table 2-2).

The complete results are presented in Sections 2 through 4 of the statistical abstract. Section 2 presents the national statistics, Section 3 the region-specific statistics, and Section 4 the State-specific statistics. Appendix C provides standard errors for the rate estimates presented in these three Sections. Standard errors

are not presented for the categorical frequency tables in this
document.

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