Census of Fatal Occupational Injury in the Agriculture, Forestry, and Fishing Industry

D. J. Murphy, A. M. Yoder

Abstract

The U.S. Department of Labor, Bureau of Labor Statistics (BLS) has developed the Census of Fatal Occupational Injuries (CFOI) program to improve the collection of occupational injury data. This article: (a) analyzes CFOI data identified by the BLS as agriculturally related for the years 1992-1995; and (b) critically examines a limited number of variables to compare the CFOI data to previously published reports of agricultural occupational fatalities. The results suggest that the CFOI system does a good job of identifying and describing injuries that it views as agricultural occupational fatalities. Future analyses need to focus on the ability of the CFOI system to capture agricultural industry incidents involving farm workers who may have another usual occupation or are unpaid or volunteer helpers.

Keywords. Surveillance systems, Occupational health, Injury, Fatalities.

Injury and illness surveillance systems develop data sets that in turn are used to design interventions to prevent or control similar future events. Surveillance systems must be able to identify and capture all targeted events if they are to realize their full potential as an injury and illness control measure (Toscano and Windau, 1992; Richardson and May-Lambert, 1997). Surveillance of fatal occupational injury in agriculture has been particularly difficult. For example, Myers and Hard (1995) reported that the National Institute for Occupational Safety and Health (NIOSH), the Bureau of Labor Statistics (BLS), and the National Safety Council (NSC) had recent occupational fatality rates for agriculture that ranged from 17 to 42 deaths per 100,00 workers. The reasons for such disparate estimates have been previously identified (Myers, 1990; Stout and Bell, 1991; Purschwitz, 1992) and are not easily resolved.

The Census of Fatal Occupational Injury (CFOI) program has been designed to overcome well documented occupational injury surveillance problems. The CFOI program involves an annual Federal/State cooperative venture to record work related fatalities using data from Federal and State agencies, business establishments, and other creditable sources. The U.S. Department of Labor's Bureau of Labor Statistics (BLS) collects the CFOI data using a multiple source system (i.e., each case is identified and verified by at least two sources).

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There are two primary purposes for this article. The first is to analyze CFOI data identified by the BLS as agriculturally related for the years 1992-1995. This type of national level analyses for the agricultural data set has not been previously published. The second purpose is to critically examine a limited number of variables to compare the CFOI data, where possible, to previously published reports of agricultural occupational fatalities.

The CFOI System

Details involving the goals, objectives, procedures and uses for the CFOI system are discussed in a article by Toscano (1993), and in other publications by the BLS (e.g., Toscano and Windau, 1992). A brief review of the CFOI system, taken from Toscano (1993), follows to orient those unfamiliar with this surveillance system.

Goals and Methods

Accurate. Two or more independent source documents or one source document and a follow-up questionnaire are used to identify and record a case.

Timely. The data are compiled and issued annually to provide data on a current basis.

Descriptive. The database contains descriptive characteristics about the deceased, their employer, and other incident details that are useful in designing prevention strategies.

Comprehensive. The use of multiple data sources allows inclusion of the self-employed, children under 16, small farms, government employees, and others often overlooked in single source document searches.

Accessible. This database is available to safety and health researchers, policy makers and other groups that are involved in promoting safety and health.

Data Sources

The CFOI system uses all of the following as possible sources to identify potential cases:

- Death certificates with the "injury at work" box marked "Yes";
- State workers' compensation reports, including first reports, claims, and insurance reports;
- Federal compensation reports, including first reports and claims;
- Federal and State agency reports, including OSHA, MSHA;
- Other federally maintained fatality reports;
- Other fatality reports: newspaper articles, medical examiner records, autopsy reports, motor vehicle reports, etc.

Note: Death certificates, worker compensation reports, and newspaper clippings are the three most common sources used in agriculture.

Data Collection

The data collection system was designed to include any person working for pay, compensation, or for profit. This is ensured by the use of multiple sources. The initial collection of data are conducted at the state level and each case is double checked so it is only counted once. When only one source is available, state agencies mail a follow-up questionnaire to business establishments for the second source. If there is no response to this questionnaire, telephone contact is made with the establishments. Once the raw data has been collected, each fatality is coded by the

individual state according to the I
then sent to the BLS for additiona

Data Uses

The BLS publishes data from
usually include the number of
occupation, type of incident, dem
The CFOI databases are also pro
making officials for their own use
researchers with data to enhance
publications.

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final 1995 data set. Therefore, dat
1992-1995 agricultural data set ha
related to agriculture, forestry, or fis
has 32 variables used to describe t
each case. Space limitations preclu
interest to readers.

Major Classification Systems.
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"Agriculture, Forestry, and Fishing".

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individual state according to the BLS format for the CFOI system. The data set is then sent to the BLS for additional review and national compilation.

Data Uses

The BLS publishes data from the CFOI system annually. These publications usually include the number of fatal occupational injuries by state, industry, occupation, type of incident, demographic summaries, and worker characteristics. The CFOI databases are also provided to safety and health researchers and policy making officials for their own use. This information provides individual states and researchers with data to enhance their own surveillance systems and to produce publications.

Data Analyses and Discussion

Agriculture, Forestry, and Fishing CFOI Data Set for 1992-1995

Data for 1992-1994 are considered complete and final: 1995 data is considered preliminary. Comparison between preliminary and final data for 1992-1994 revealed insignificant differences between the two data sets. Little change is expected in the final 1995 data set. Therefore, data compared will be for 1992-1995. The entire 1992-1995 agricultural data set has a maximum of 4,036 cases identified as being related to agriculture, forestry, or fishing by industry, occupation, or both. Each case has 32 variables used to describe the incident. Not all categories are complete for each case. Space limitations preclude presentation of all variables that may be of interest to readers.

Major Classification Systems. The Standard Industrial Classification (SIC) system and the Occupational Classification System (OCS) are the two major systems used to identify and classify agricultural occupational injuries in the CFOI system (U.S. Department of Labor, 1996). The SIC Manual is the official U.S. government code book for defining and describing major U.S. industrial groups (Office of Management and Budget, 1987). The term "industry", as used in the SIC manual, refers to "establishments where business is conducted or services performed". An industry consists of a group of establishments primarily engaged in the same general economic activity. The SIC title for the agricultural industry is "Agriculture, Forestry, and Fishing" and contains five major groups that further define and describe the industry. There are 3295 cases with an SIC code for "Agriculture, Forestry, and Fishing".

The OCS codes (U.S. Dept. of Commerce, 1990), defined by the Bureau of the Census for the 1990 U.S. Census, are a condensed version of the occupational codes in the 1980 Standard Occupation Classification (SOC) Manual. The SOC Manual is the official U.S. government code for defining and categorizing major occupational groups (U.S. Dept. of Commerce, 1980). The term "occupation", as used in both the SOC and OCS codes, refers to "type of activity performed". The OCS title for agricultural occupations is "Farming, Forestry, and Fishing Occupations" and consists of five major groups that further define and describe the occupations. There are 3715 cases with an OCS code for "Farming, Forestry, and Fishing".

In the CFOI system, each case has a space for a brief narrative describing how the injury or illness occurred. The narratives were used to substantiate the correctness of the 3295 cases assigned to the SIC "Agricultural, Forestry, and Fishing" codes by the CFOI system. Of the 3295 cases, 3241 (98.4%) included a useful narrative (some narratives had one word descriptions that did not provide

additional information). Only two cases were found that seem to be miscategorized. One case was a tractor that had overturned on a man mowing grass behind his auto dealership. The industry of employment was classified as livestock. The second case was a circus trainer that was crushed by an attacking elephant. The industry of employment was classified as "Animal Specialty" rather than "Entertainment". Project limitations precluded examining the remaining 22,057 case narratives from the CFOI database to see if there were cases that should have been included in the agricultural data set but were not. Nevertheless, the exceptional accuracy of cases that were coded as agricultural suggests that CFOI system does an excellent job of identifying agriculturally related cases.

Differences Between Major Classification Systems. Although both CFOI classification systems (SIC, OCS) have similar titles, "Agriculture, Forestry and Fishing" (hereafter referred to as the agricultural industry) and "Farming, Forestry and Fishing" (hereafter referred to as farm occupations), the groups are not identical. There are two major differences between these systems. The first difference is that not all workers with a farm occupation code work in the agricultural industry. For example, there were 741 cases (18.4%) for which a farm occupation code was listed, but the industry code was a non-agricultural industry. A large percentage of these were in the SIC group "Lumber and wood products, except furniture" (62%). Other examples include "Amusement and recreational services" (5.9%), "Wholesale trade, nondurable goods" (2.6%) and "Real estate" (2.4%). The remainder of the cases fell into the Unclassified, Unknown, or Other categories with 5.5%, 3.4% and 18.0%, respectively. The Other category consisted of 31 non-agricultural industries were farming occupations were found.

The second difference is that there are many non-farm occupations present in the agricultural industry. For example, there were 321 cases (8%) with a non-farm occupation and an agricultural industry code. Two large groups from these 321 cases were "airplane pilots and navigators" and "truck drivers" with 18.7% and 17.8%, respectively, followed by "Laborers, except construction" (15.3%) and "Managers and administrators, n.e.c." (7.2%). The remainder of the cases fell into the Unknown and Others categories. The Other category consisted of 68 non-farming occupations found in the agricultural industry.

Because the SIC and OCS groups are not equivalent groups, direct comparison of the data between these two classification groups is inappropriate. Traditionally, agricultural fatality data has been presented by SIC codes (Stout-Wiegand, 1988; Toscano, 1993; Myers and Hard, 1995). Although the reasons for this were not found discussed in the literature, one reason may be that the structure of the SIC codes seems to more clearly define the types of exposures that are of interest to safety and health professionals. For example, under the SIC structure, a fatality to an employee of a dairy farm operation could be easily separated from a fatality to an employee of beef farm operator, and both of these could be easily separated from a fatality to an employee of a farm operation that was raising grain. But under the OCS structure, all three of these employees would be grouped in the same category of "farm workers" under the major group of "Other Agricultural and Related Occupations".

Table 1 presents the CFOI agricultural industry data set by major groups and subgroups of the SIC code for years 1992-1995. The major and subgroups are presented in their entirety so that readers can readily identify how cases are distributed across the various categories. Table 1 identifies an average of 824 cases over the four years, and shows that there is little variation across the years. For

Table 1. The 1992-19

Major Groups and Subgroups	1992 (No.)	(%
Ag Production-Crops	407	50.
Cash grains	21	2.
Field crops, except cash grains	15	1.
Vegetables and melons	9	1.
Fruits and tree nuts	19	2.
Horticultural specialties	8	1.
General farms, primarily crops	225	27.
Unknown subgroup	110	13.
Ag Production-Livestock	165	20.
Livestock, except dairy and poultry	48	5.
Dairy farms	53	6.
Poultry and eggs	6	0.
Animal specialties	4	0.
General farms, primarily livestock and animal specialties	42	5.
Unknown subgroup	12	1.
Ag Services	138	17.0
Soil preparation services	3	0.4
Crop services	30	3.7
Veterinary services	2	0.2
Animal services, except veterinary	5	0.6
Farm labor and management services	9	1.1
Landscape and horticultural services	87	10.7
Unknown subgroup	2	0.2
Forestry	20	2.5
Timber tracts	10	1.2
Forest nurseries and gathering of forest products	0	0.0
Forestry services	9	1.1
Unknown subgroup	1	0.1
Fishing, Hunting, & Trapping	83	10.2
Commercial fishing	79	9.7
Fish hatcheries and preserves	1	0.1
Hunting and trapping, and game propagation	2	0.2
Unknown subgroup	1	0.1
Totals	813	100

example, the percentage of cases in 46.2% to a high of 51.6% between 19

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Table 1. The 1992-1995 agricultural fatality cases by SIC codes

Major Groups and Subgroups	Year 1992 (No.)	1992 (%)	1993 (No.)	1993 (%)	1994 (No.)	1994 (%)	1995 (No.)	1995 (%)	Total (No.)	Average (No.)	Average (%)
Ag Production-Crops	407	50.1	400	46.2	443	51.6	365	48.2	1615	403.75	49.0
Cash grains	21	2.6	44	5.1	29	3.4	28	3.7	122	30.5	3.7
Field crops, except cash grains	15	1.8	21	2.4	26	3.0	34	4.5	96	24	2.9
Vegetables and melons	9	1.1	14	1.6	10	1.2	8	1.1	41	10.25	1.2
Fruits and tree nuts	19	2.3	24	2.8	20	2.3	26	3.4	89	22.25	2.7
Horticultural specialties	8	1.0	8	0.9	14	1.6	4	0.5	34	8.5	1.0
General farms, primarily crops	225	27.7	185	21.4	248	28.9	210	27.7	868	217	26.3
Unknown subgroup	110	13.5	104	12.0	96	11.2	53	7.0	363	90.75	11.0
Ag Production-Livestock	165	20.3	214	24.7	172	20.0	162	21.4	713	178.25	21.6
Livestock, except dairy and poultry	48	5.9	61	7.1	49	5.7	67	8.8	225	56.25	6.8
Dairy farms	53	6.5	75	8.7	70	8.1	46	6.1	244	61	7.4
Poultry and eggs	6	0.7	5	0.6	8	0.9	8	1.1	27	6.75	0.8
Animal specialties	4	0.5	8	0.9	8	0.9	7	0.9	27	6.75	0.8
General farms, primarily livestock and animal specialties	42	5.2	52	6.0	24	2.8	28	3.7	146	36.5	4.4
Unknown subgroup	12	1.5	13	1.5	13	1.5	6	0.8	44	11	1.3
Ag Services	138	17.0	155	17.9	164	19.1	155	20.4	612	153	18.6
Soil preparation services	3	0.4	4	0.5	5	0.6	0	0.0	12	3	0.4
Crop services	30	3.7	31	3.6	39	4.5	36	4.7	136	34	4.1
Veterinary services	2	0.2	3	0.3	2	0.2	6	0.8	13	3.25	0.4
Animal services, except veterinary	5	0.6	8	0.9	6	0.7	9	1.2	28	7	0.8
Farm labor and management services	9	1.1	11	1.3	10	1.2	13	1.7	43	10.75	1.3
Landscape and horticultural services	87	10.7	93	10.8	100	11.6	91	12.0	371	92.75	11.3
Unknown subgroup	2	0.2	5	0.6	2	0.2	0	0.0	9	2.25	0.3
Forestry	20	2.5	9	1.0	15	1.7	16	2.1	60	15	1.8
Timber tracts	10	1.2	2	0.2	6	0.7	6	0.8	24	6	0.7
Forest nurseries and gathering of forest products	0	0.0	0	0.0	0	0.0	2	0.3	2	0.5	0.1
Forestry services	9	1.1	4	0.5	9	1.0	7	0.9	29	7.25	0.9
Unknown subgroup	1	0.1	3	0.3	0	0.0	1	0.1	5	1.25	0.2
Fishing, Hunting, & Trapping	83	10.2	87	10.1	65	7.6	60	7.9	295	73.75	9.0
Commercial fishing	79	9.7	84	9.7	64	7.5	58	7.7	285	71.25	8.6
Fish hatcheries and preserves	1	0.1	3	0.3	0	0.0	0	0.0	4	1	0.1
Hunting and trapping, and game propagation	2	0.2	0	0.0	1	0.1	2	0.3	5	1.25	0.2
Unknown subgroup	1	0.1	0	0.0	0	0.0	0	0.0	1	0.25	0.0
Totals	813	100	865	100	859	100	758	100	3295	824	100

example, the percentage of cases in Ag Production-Crops ranged from a low of 46.2% to a high of 51.6% between 1992 and 1995.

Even though the SIC and OCS classification systems are not directly comparable, data from each system can be looked at together to see if any important trends emerge. For example, the National Institute for Occupational Safety and Health's (NIOSH) National Traumatic Occupational Fatality (NTOF) classification system has previously established that 78.6% of agricultural industry cases are associated with production agriculture (Myers, 1989). To see if the farm occupation code would reveal similar results, a matrix of cases was developed where both an agricultural industry and farm occupation code were indicated for the case. Both codes were indicated for 2,974 cases. The data in table 2 illustrates how the number of cases varies by major group for each coding system. In table 2, SIC codes are on the vertical axis (percent figures add horizontally to 100), while OCS codes are displayed on the horizontal axis (percent figures in parentheses add vertically to 100). The important finding from this table is that no matter which way the data are coded, a large majority of cases are found in the four cells that are most closely identified with the practices and activities associated with farms and farming. For example, with SIC coding livestock and crop production accounted for 2,209 of the 2,974 cases (74.3%), while with OCS coding, Farm Operators and Managers and Other Agricultural and Related Occupations accounted for 2,360 of 2,974 cases

Table 2. The 1992-1995 agricultural fatality cases by agricultural industry and farm occupations

	OCS Major Groups										
	Farm Operators and Managers		Other Agricultural and Related Occupations		Related Agricultural Occupations		Forestry and Logging Occupations		Fishers, Hunters, and Trappers		
SIC Major Groups	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)	Total
01-Ag production — crops	969	69.2 (63.1)	560	58.4 (36.5)	4	1.6 (0.3)	1	1.4 (0.1)	1	0.3 (0.1)	1535 (100.0)
02-Ag production — livestock	358	25.6 (53.1)	300	31.3 (44.5)	3	1.2 (0.4)	11	15.1 (1.6)	2	0.7 (0.3)	674 (100.0)
07-Ag services	67	4.8 (15.4)	91	9.5 (21.0)	247	97.2 (56.9)	29	39.7 (6.7)	0	0.0 (0.0)	434 (100.0)
08-Forestry	5	0.4 (11.4)	7	0.7 (15.9)	0	0.0 (0.0)	32	43.8 (72.7)	0	0.0 (0.0)	44 (100.0)
09-Fishing, hunting, & trapping	2	0.1 (0.7)	1	0.1 (0.3)	0	0.0 (0.0)	0	0.0 (0.0)	284	99.0 (99.0)	287 (100.0)
Total	1401	100	959	100	254	100	73	100	287	100	2974

(79.4%). Conversely, with SIC coding, only 11% of the cases (331 of 2,974) were identified with the forestry and fishing industry groups. Similarly, with OCS coding, only 12% of the cases (360 of 2,974) were identified with the forestry and fishing groups. Because of the small percentage of cases identified in these groups, they will not be further discussed in this article.

Descriptive Data. The remainder of our analyses will use only cases identified as agricultural industry by the SIC code. The distribution of some demographic variables of those cases included by the agricultural industry coding system are given in figures 1-2. The data suggest that there is little variation in the data across the years.

The distribution of agricultural fatalities by age groups is shown by the data in figure 1. Age information was available for 3,290 of the 3,295 cases in the agricultural industry data set. The large percentage of cases for age group 65 and over, 26%, is consistent with other reports (e.g., see Purschwitz, 1997). An age group, those 19 years and under, that is often identified as annually contributing a

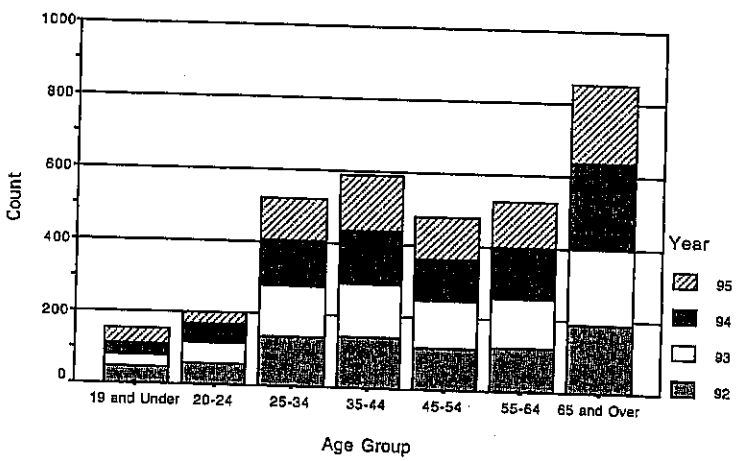

Figure 1–The 1992-1995 agricultural fatalities by age groups.

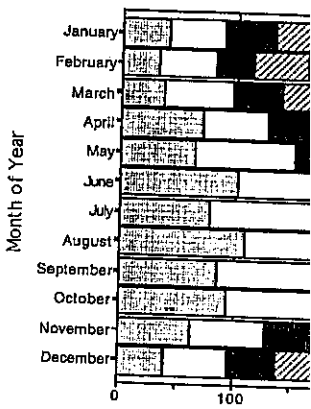

Figure 2–The 1992-1995

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ltural industry and farm occupations

Groups						
	Forestry and Logging Occupations		Fishers, Hunters, and Trappers			
%)	(No.)	(%)	(No.)	(%)	Total	
.6	1	1.4	1	0.3	1535	
.3)		(0.1)		(0.1)		(100.0)
.2	11	15.1	2	0.7	674	
.4)		(1.6)		(0.3)		(100.0)
.2	29	39.7	0	0.0	434	
.9)		(6.7)		(0.0)		(100.0)
.0	32	43.8	0	0.0	44	
.0)		(72.7)		(0.0)		(100.0)
.0	0	0.0	284	99.0	287	
.0)		(0.0)		(99.0)		(100.0)
	73	100	287	100	2974	

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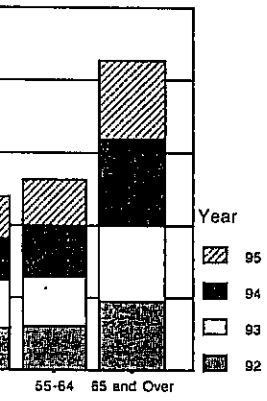

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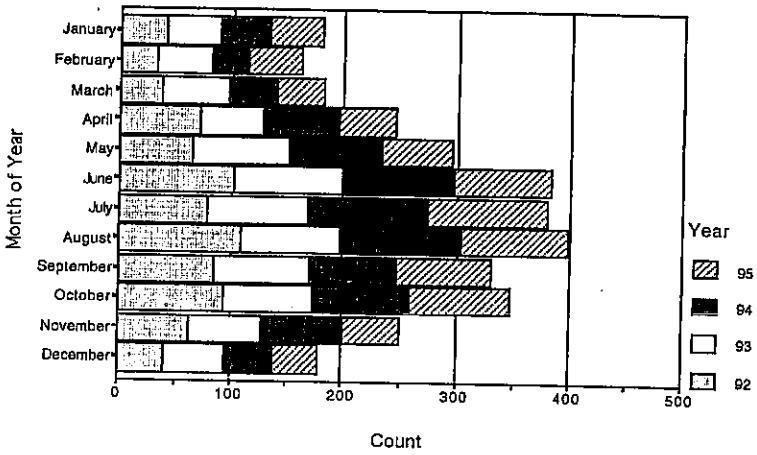

Figure 2–The 1992-1995 agricultural fatalities by month of year.

large percentage of cases to agriculture's total (e.g., see Purschwitz, 1997) does not present itself significantly in the CFOI system.

As seen in figure 1, only about 5% of all cases are attributed to persons 19 years and younger. A major reason for this is that youth 14 and under are not normally viewed as having "occupational" status by federal agencies (National Center for Health Statistics, 1988) or others (newspaper writers, safety and health professionals, etc.). Thus, the Industry and Occupation categories on death certificates for children and adolescents are often left blank and/or are filled in as "Student". Additionally, the "Injury at Work" question is checked "No" because this question is in reference to the "usual occupation" of the person.

The other two source documents also commonly used for agricultural cases—worker compensation reports and newspaper clippings (Toscano, 1993)—may also fail to detect fatal injuries to youth working in the agricultural industry. Much child labor in agriculture is unpaid labor on family farms or on a relative's farm; therefore a worker compensation report is not filed in the event of an injury. An injury to a child may not make the local newspaper. Or if it does, it may not contain sufficient or accurate information regarding the circumstances of the fatality, including whether or not a child was working at the time of the fatal event. In the absence of clear documentation that a youth was formally employed in the agricultural industry, the case may not be included in the CFOI system.

Injury reports generated at a state level by cooperative extension may not make any distinction concerning the occupational status of a youth fatally injured from exposure to a farm hazard. This may be why several reports have youths 15 years of age and under accounting for 20-25% of the total fatalities in their state (Tormoehlen, 1986; Wilkinson and Field, 1990; Murphy and Ambe, 1996), but our analyses only found 5% of cases for youths 19 and under. The averages of the 20-24, 25-34, 35-44, 45-54 and 55-64, age groups are 6%, 16%, 18%, 14%, and 16%, respectively, and are more in line with previously published reports (Purschwitz, 1997.

The bar graph in figure 2 shows in what months of the year most agricultural fatalities occurred. While strong farm production activity is year-around for some states (e.g., California, Florida), production activity in midwest and northern states slows considerably during cold weather months due to less crop production. The data show that fatalities are most numerous during the summer months (June-

August) with 1,163 incidents, and are at their lowest during the winter months (December-February) with 519 incidents. This trend is consistent with: increased exposure to work hazards during the growing season for all states, more hours of exposure from longer work days for all states, and a larger number of exposed workers for all states (e.g., children are out of school, temporary workers are hired for haying). Although June-August was the peak quarter for fatal incidents, the number of incidents did not fall off appreciably during September or October. These are prime crop harvesting months in the midwest.

A substantial amount of agricultural work does not lend itself to a five day work week. Fatal incidents occurred each day of the week, with Wednesday having the highest number of incidents (578), and Sunday the fewest incidents (272). The number of incidents was spread fairly evenly throughout the week. The total fatalities for each day of the week were; Sunday, 272; Monday, 540; Tuesday, 516; Wednesday, 578; Thursday, 474; Friday, 528; Saturday, 422. Sunday was the only day with less than 300 incidents.

Most fatal incidents occur between 8:00 A.M.and 6:00 P.M., accounting for 82% of the total cases. These hours are included within the normal working day for most in agriculture, although not totally inclusive for some. For example, the normal working hours for many dairying operations may begin before 6:00 A.M. and may not end until after 7:00 P.M. The largest number of incidents occurred at 10:00 A.M., 2:00 P.M., and 4:00 P.M. with a total of 246, 271, and 268 cases, respectively. The day of the week and time of day data shows that a fatal incident can strike a farm or farm worker at almost any hour of the day on any day of the week.

Cases by Source of Injury. One major purpose for analyzing injury surveillance data is to use the data to direct and/or target injury prevention activity (Baker et al., 1989). Source of injury is one key data element that serves this purpose. The published literature on agricultural injury suggests that there is little consensus among researchers on how to group agricultural source of injury data. For example, reports by National Safety Council (1996), Myers and Hard (1995), and Purschwitz and Skjolaas (1995) all have different major source of injury categories. Of special interest, for this article, is the identification of tractors and other machinery as major sources of fatal injury. Machinery, including tractors, has long been identified as the leading source (agent/cause) of fatal farm work injury in national surveillance system reports (Fritsch and Zimmer, 1980; National Safety Council, 1982; Myers and Hard, 1995). Most of these summaries include tractors in their machinery category, and find that this category (Machinery, including tractors) contributes from 40% to 50% to the total number of fatalities (Myers and Hard, 1995; National Safety Council, 1996). Many state reports identify tractors separately from other agricultural machines, and attribute a larger proportion of fatal injury to the combined group. For example, in reports produced by Bernhardt and Langley (1993), Purschwitz and Skjolaas (1995), and Murphy and Ambe (1996), tractors and machinery combined contributed 60.3%, 75.6% and 74.5%, respectively, to the total number of fatal injuries. The source of injury data from the CFOI data set were analyzed to see if a similar percentage of tractor and machinery related cases would be identified. Source of injury major categories and the number and percent each category contributes to the total are presented in table 3.

In table 3, tractors are not identified as a major source of injury group, but there is a Machinery category. At first glance, it would appear that the CFOI system significantly underidentifies tractor and machinery cases. That is, an average of 16% Machinery cases is substantially lower than the 40% to 50% of cases noted in national reports, and 60% to 75% of cases from state reports. Direct comparisons,

Table 3. The 1992-1995 agricu

All Agriculture	—
Source	(1
Chemicals and chemical products	
Containers	
Furniture and fixtures	
Machinery	15
Parts and materials	3
Person, plant, animals, and minerals	(
Structures and surfaces	4
Tools, instruments, and equipment	1
Vehicles	38
Other sources	7
Nonclassifiable	
Totals	81

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Table 3. The 1992-1995 agricultural fatalities in BLS source of injury categories

All Agriculture	Year									
	1992		1993		1994		1995		Average	
Source	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)	(No.)	(%)
Chemicals and chemical products	14	1.7	11	1.3	15	1.7	12	1.5	13	1.6
Containers	10	1.2	13	1.5	8	0.9	15	1.9	12	1.4
Furniture and fixtures	0	0.0	1	0.1	0	0.0	0	0.0	0	0.0
Machinery	159	19.6	140	16.2	115	13.4	105	13.2	130	15.6
Parts and materials	37	4.6	40	4.6	38	4.4	37	4.6	38	4.6
Person, plant, animals, and minerals	67	8.2	87	10.1	67	7.8	68	8.5	72	8.7
Structures and surfaces	43	5.3	57	6.6	58	6.8	59	7.4	54	6.5
Tools, instruments, and equipment	18	2.2	5	0.6	14	1.6	12	1.5	12	1.5
Vehicles	384	47.2	445	51.4	462	53.8	417	52.3	427	51.2
Other sources	75	9.2	62	7.2	79	9.2	71	8.9	72	8.6
Nonclassifiable	6	0.7	4	0.5	3	0.3	1	0.1	4	0.4
Totals	813	100	865	100	859	100	797	100	833.5	100

however, cannot be made with previous national and state reports because the CFOI system introduces yet another way that tractor and machinery cases are grouped. As previously stated, the CFOI system, while not having a major category for tractors, does have a major category for Machinery. However, the Machinery category, as the primary source of injury, does not include most tractor-related incidents. For example, in table 4 tractor incidents with Machinery as the primary source make up only 9.9% of the total cases. As the primary source, tractor incidents are identified mainly (85.2% of the time) as a subgroup under the "Vehicle" category.

The COFI system also identifies a secondary source of injury. The primary source identifies the object, substance, bodily motion, or exposure which *directly produced or inflicted* the identified injury or illness. The secondary source identifies the object, substance or person that *generated* the source of injury or illness or that *contributed to* the event or exposure (Bureau of Labor Statistics, 1992). No evidence could be found in the literature that a distinction between primary and secondary source of injury was made in any previous analyses of agricultural work fatality data.

To demonstrate the impact of a secondary source code, the narratives of all agricultural industry cases were reviewed to find any mention of a tractor. This identified 1,070 cases, or 32.5% of the total. This percent is similar to some state reports for fatal injuries involving tractors (Purschwitz and Skjolaas, 1995; Pürschwitz, 1997), but less than others (Myers, 1990; Bernhardt and Langley, 1993). These 1,070 cases were then grouped by primary source and secondary source of injury codes and are presented in table 4.

The data in table 4 illustrates that not all tractor related cases are found in one specific source of injury category, regardless of whether it was coded as a primary source or a secondary source of injury. As previously stated, a large percentage of tractor-related cases (85.2%) were found under Vehicles. The next largest group (9.9%) was found under Machinery. The remaining 4.9% of tractor-related cases were found as a secondary source of injury under Vehicles. A search for Vehicles-tractor in both primary and secondary source categories resulted in 987 (92.2%) cases. This illustrates that more cases involving tractors can be found if the Vehicles-tractor code is used to search both the primary and secondary source of injury variables. Because the CFOI system has neither "tractors" as one of its main categories, nor has it as a specific subgroup under Machinery, as has been traditionally done, it is possible that the single largest cause of fatal occupational

Table 4. The 1992-1995 tractor-related fatalities in BLS primary and secondary source of injury categories

Primary Source	Secondary Source	Number	Percent
Chemicals	Vehicles-tractor	2	0.2
Containers	Vehicles-tractor	9	0.8
Machinery	Blank	79	7.4
Machinery	Structures and surfaces	4	0.4
Machinery	Vehicles-tractor	22	2.1
Parts and materials	Vehicles-tractor	15	1.4
Person, plants, animals, and minerals	Vehicles-tractor	8	0.7
Structures and surfaces	Vehicles-tractor	4	0.4
Vehicles-other than tractor	Vehicles-tractor	13	1.2
Vehicles-tractor	Blank	671	62.7
Vehicles-tractor	Chemicals	2	0.2
Vehicles-tractor	Containers	7	0.7
Vehicles-tractor	Machinery	23	2.1
Vehicles-tractor	Parts and materials	5	0.5
Vehicles-tractor	Person, plants, animals, and minerals	33	3.1
Vehicles-tractor	Structures and surfaces	69	6.4
Vehicles-tractor	Vehicles-other than tractor	59	5.5
Vehicles-tractor	Vehicles-tractor	5	0.5
Vehicles-tractor	Other sources	37	3.5
Other sources	Vehicles-tractor	3	0.3
Total		1070	100

injury in agriculture may be overlooked in some analyses. This is particularly true with researchers who are not intimately familiar with agricultural work injury incidents. Therefore, researchers need to be aware that tractors are grouped under the vehicle category, and that both primary and secondary source categories must be searched to find them.

Summary and Conclusions

The CFOI system presents a new opportunity to analyze fatal agricultural occupational fatalities from a national perspective. However, it is difficult—if not impossible—to make many direct comparisons with previous reports of agricultural injury not using the CFOI system. This does not mean that the CFOI system is not an improvement over previous or other current systems for surveillance of fatal agricultural injury. Indeed, such an evaluation is yet to be determined: it will require considerably more study and analyses than can be presented in a single article. Nevertheless, a few tentative conclusions about the CFOI system and its 1992-1995 agricultural data set can be drawn. These include:

1. Of those cases identified as agriculturally related, the CFOI system does a remarkably good job of coding the case to the appropriate SIC major group.
2. The activities associated with farming, or production agriculture, account for a large majority of all occupational fatality cases regardless of which major classification system (SIC or OCS) one uses to define the agricultural data set.
3. There is relatively little variation from one year to another in the number of cases or in major characteristics that describe the incidents.
4. The greatest number of fatal injury incidents occur at times of the year when exposure to farm work is at its greatest.
5. Since the CFOI system is c
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   19 years of age and under.
6. The CFOI system introduc
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	9	0.8
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	8	0.7
	4	0.4
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	671	62.7
	2	0.2
	7	0.7
	23	2.1
	5	0.5
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	5	0.5
	37	3.5
	3	0.3
	1070	100

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5. Since the CFOI system is designed to report fatal occupational injuries, it does not do a good job of identifying all fatal injury incidents to persons 19 years of age and under.
6. The CFOI system introduces source of injury coding that is substantially different from traditional ways of grouping a large percentage of the incidents. Therefore, direct comparisons with past agricultural source of injury data are inappropriate.
7. A major source of fatal occupational injury, tractors, may be under represented in a brief or casual review of the agricultural data set.

As stated earlier, one measure of the value of a national injury surveillance system is its ability to capture all the events of interest to those who desire to use the data set for injury prevention purposes. From this initial analyses, the CFOI system appears to do a good job of capturing agricultural industry incidents, except to persons 15 years of age and younger. Because the procedures for identifying source of injury (main *and* secondary codes, different major categories) are different, direct comparison with past agricultural injury reports is problematic. Nevertheless, future state, regional and national reports could soon be comparable if researchers began to use the CFOI coding system for their own analyses and reports. Future analyses may want to focus on the ability of the CFOI system to capture agricultural industry incidents involving farm workers who may have another usual occupation, or are unpaid or volunteer helpers.

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The Keokuk County Rural Health S
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from among the first 653 participants
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Keywords. Pesticide, Agriculture, Exp

Agricultural chemicals used on m
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