

# A Comparison of Agricultural Injuries Between the Young and Elderly: New York and Kentucky

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## Abstract

Injury cases from the New York and Kentucky Occupational Health Nurses in Agricultural Communities programs were examined for differences between those aged 18 to 59 and those greater than 59 years to identify and understand unique factors associated with the older farmer. Overall, the injuries sustained by the elderly were more severe than those in the younger age group. A significantly higher frequency of injuries caused by machines, especially tractors, and overexertion occurred in the older age group. The older population experienced more fatal injuries and injuries which resulted in hospitalizations than the younger population. Further research is needed about factors contributing to these injuries including physical limitations, economic issues and behavior.

*Keywords.* Agriculture, Elderly, Injuries, Surveillance.

**I**t is currently estimated that over 34,000,000 Americans are 65 years of age and over, and it is projected that the size of this population will more than double by the year 2050 (U.S. BC, 1996). With the aging of the American population, more and more individuals will continue to work as they get older. Unfortunately, high rates of work-related fatal injuries occur among workers aged 65 years and older (Jenkins, 1993; Kisner, 1997; Mitchell, 1988). In 1995, workers 65 years and over had a fatality rate of 14 per 100,000 employed, which was higher than any other age group (U.S. DOL, 1997). Although older workers generally have lower nonfatal injury rates than younger workers do, they tend to have poorer health outcomes once they become injured (Castillo, 1997; Mitchell, 1988). In 1996, workers aged 65 and over had a median of 12 days away from work due to occupational injury and illness in New York State, and 15 days in Kentucky, which was higher than any other age group (N.Y.S. DOL, 1997; Commonwealth of Kentucky Labor Cabinet, 1998a).

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According to the 1997 Census of Agriculture, there were 1,911,859 farms in the United States, with 82,273 in Kentucky and 31,757 in New York. Twenty-six percent of all farm operators in the United States were 65 years of age or older with the average age 54.3 years. In New York and Kentucky, 23% and 25% of all farm operators, respectively, were 65 years of age or older (U.S. DA, 1999).

Nationwide, agriculture had one of the highest fatality rates in 1997 (23.4 per 100,000 workers), accounting for 13% of all occupational fatalities (U.S. DOL, 1998). In 1996, 19% of occupational fatalities in New York State, excluding New York City, and 24% of occupational fatalities in Kentucky were in the agriculture industry (N.Y.S. DOH, 1998a; Commonwealth of Kentucky Labor Cabinet, 1998b). Of those workers over 65 years of age in New York in 1997, 31% of the occupational fatalities occurred among farmers while only 15% of occupational fatalities among people 18 to 65 years of age occurred among farmers (U.S. DOL, 1999). Similarly in Kentucky, between 1994 and 1998, 72% of the fatalities to those over age 65 were in the agriculture industry while only 18% were in the agriculture industry for those aged 18 to 65 (Arthur, 1999).

Some of the highest rates of occupational injuries occur in agriculture (National Safety Council, 1996). It is estimated that 3600 male farmers age 55 and older will be injured in Kentucky each year (Browning, 1998). Among the lost-time injuries for New York and Kentucky farm workers, 12% and 10%, respectively, occurred among workers 60 years and over (Myers, 1998).

Because the number of working elderly in the United States will continue to increase, it is important to identify job-related risks for this population. Specific prevention strategies for the elderly should focus on the most hazardous industries, including agriculture.

## Methods

The Occupational Health Nurses in Agricultural Communities (OHNAC) program was a surveillance initiative conducted between 1991 and 1996, supported by the National Institute for Occupational Safety and Health in 10 states, including New York and Kentucky. The program was designed to study agricultural injury patterns which would direct the development and evaluation of interventions and serve as a model for future surveillance initiatives. Therefore, a variety of surveillance methods were used to collect injury information. Because the states were geographically separated, a variety of agricultural commodities, terrain, work methods and climate were represented. The leading three commodities in New York are dairy products, nursery and greenhouse crops, and vegetables, sweet corn and melons; and in Kentucky are tobacco, cattle and calves, and other livestock and livestock products (U.S. DA, 1999). Common injuries across these diverse conditions can be identified. This article examines the findings of two state programs. Because these programs were designed independently, the case identification process, along with the data collection and coding, were different between the two states. Therefore, direct comparisons between all data elements are not always possible; however, associations between age and specific risks can be identified.

In New York, three OHNAC nurses with agricultural backgrounds were located in three areas of upstate New York. The nurses actively collected information about any farm incidents from various sources including emergency departments, local extension agents, news media and self-referral. Upon learning of an incident, the nurse would obtain verbal consent, visit the farm and record relevant details into a database. For investigations involving fatalities and serious injuries, an agricultural

engineer from Cornell University would often accompany the nurse. During the study period (October 1991-September 1996), 873 investigations were conducted, 141 to persons older than 59 years and 600 to those between 18 and 59.

In Kentucky, the OHNAC community-based registered nurses abstracted data from all emergency department medical records in a nine county area and conducted follow-up interviews after obtaining verbal consent. During the time period (April 1992-September 1996), 2,366 total injuries were recorded; 340 of these to persons older than 59, and 1,640 to those 18 to 59 years. Following a farm visit, a core questionnaire of 34 items was completed for each of these injuries and entered into a database. A case was defined as any incident occurring on a farm that required medical treatment. Complete emergency department record reviews were conducted biannually to identify any missing cases. Joint investigations with a Fatality Assessment and Control Evaluation (FACE) investigator were conducted on fatal incidents.

For this analysis, acute injury incidents involving individuals 60 years and over were compared to incidents involving adults from 18 to 59 years of age. Chi-square statistics were calculated on categorical variables and two-independent sample t-tests were run on continuous variables. Because of coding differences between the New York and Kentucky databases, direct comparisons between the states were not possible for all characteristics. Standardized codes from the U.S. Department of Labor, Bureau of Labor Statistics, were used to code source and event of injury in New York (U.S. DOL, 1992). The International Classification of Diseases 9th Revision was used to code the cause and nature of injury in Kentucky (Karaffa, 1993).

## Results

Table 1 displays the demographic characteristics and agricultural background of the injury cases investigated in the two states. Most of the injured farmers were white males, and there were no significant differences in sex or race between the 18 to 59 and the 60 and over age groups. Among the elderly in New York, more were full-time farmers or hobby farmers, while there were more employees among the younger adults. Most of the injuries in New York occurred on dairy farms. A high proportion of the injuries investigated in New York State was on dairy farms because the nurses had better access to dairy farms than other types of farms. Younger farmers in New York tended to farm more acres than older farmers (mean = 335 acres, s.d. = 486 vs mean = 255 acres, s.d. = 393, p-value = 0.05).

The source of injury is displayed in table 2 and the event causing the injury is displayed in table 2 for New York. Table 3 displays similar data for Kentucky as classified by ICD-9 E-codes. In both states, older farmers had significantly more transportation accidents, particularly those involving tractors, than younger farmers did. Meanwhile, younger farmers had significantly more exposure to chemicals, including silo gas. There were no differences identified for injuries related to animals or tools. While there was no statistical difference between injuries due to bodily reactions in New York, 62% of these involving younger farmers were due to overexertion while 60% of these involving older farmers were due to heart attacks. In Kentucky, younger farmers had significantly more overexertion injuries. A higher proportion of the injuries in the younger population in Kentucky was due to tobacco knives. It is likely that younger persons cut tobacco, an activity requiring bending, stooping and twisting, and are therefore more likely to be injured by tobacco knives and sustain back injuries than older persons. To further examine the high incidence of tractor-related injuries among the elderly, the age of the tractors used in New

**Table 1. Demographics and farm characteristics of injury cases**

	18-59 Years		60+ Years		$\chi^2$	df
	N	(%)	N	(%)		
New York State	539		120			
Sex					0.28	1
Male	476	88.3	108	90.0		
Female	63	11.7	12	10.0		
Race					1.65	2
White	502	93.1	119	99.2		
Black	6	1.1	0	0		
Other	31	5.8	1	0.8		
Relationship to farm					50.36*	5
Full-time farmer	225	42.5	81	67.5		
Part-time farmer	57	10.8	6	5.0		
Employee	180	33.0	8	6.7		
Hobby	11	2.1	8	6.7		
Visitor	14	2.6	2	1.7		
Other	42	7.9	15	12.5		
Farm type					19.50*	5
Cash grain	31	5.7	14	12.2		
Dairy	326	62.2	62	53.9		
Livestock	42	7.8	17	14.8		
Orchard	46	8.8	5	4.4		
Vegetable	34	6.5	2	1.7		
Other	47	9.0	15	13.0		
Kentucky	1640		340			
Sex					1.11	1
Male	1386	84.5	295	86.8		
Female	254	15.5	45	13.2		
Race†					4.6	2
White	1559	96.2	331	97.6		
Black	31	1.9	7	2.1		
Other	31	1.9	1	0.3		
Relationship to farm†					62.03*	1
Farmer/family	1014	64.3	290	86.3		
Other (visitor, worker)	564	35.7	46	13.7		

\* p-value  $\leq 0.01$ .

† Nineteen people aged 18 to 59 missing race, 1 aged 60+ missing race; 62 people aged 18 to 59 missing relationship to farm, 4 aged 60+ missing relationship to farm.

York was examined. In general, the older farmers were significantly more likely to use older tractors (average tractor age = 28 years) than younger farmers (average tractor age = 19.9 years, p-value < 0.01).

Figure 1 displays data from Kentucky for part of the body injured. The older population had significantly more injuries to the chest (p-value < 0.01) but fewer injuries to the lower limbs (p-value < 0.05) and back (p-value < 0.05) than the younger population. This information was not readily available from New York.

Table 4 shows the outcome of the injury. In both states, the elderly were significantly more likely to die as a result of their injury or to be hospitalized (as defined by inpatient stay), suggesting the injuries to the older populations were more severe. Of interest is that there was no difference in total work-time lost or length of hospitalization by age group in New York.

Further investigation was conducted examining whether there was an association between the high occurrence of tractor-related incidents and fatalities among the elderly in New York. Approximately half of the elderly fatalities occurred in tractor-

**Table 2. Source of injury and injury event, New York State**

Source of Injury	18-59 Years		60+ Years		$\chi^2$
	N	(%)	N	(%)	
Source of Injury	539		120		
Chemicals	84	15.6	1	0.8	19.01*
Containers	16	3.0	3	2.5	1.19†
Machinery	71	13.2	13	10.8	0.48
Agricultural	45	8.4	5	4.2	2.45
Construction	11	2.0	4	3.3	0.74
Parts and materials	45	8.4	9	7.5	0.09
Machine parts	36	6.7	7	5.8	0.12
Persons, animals	114	21.2	22	18.3	0.48
Animals	69	12.8	13	10.8	0.35
Structures, surfaces	11	2.0	4	3.3	0.60†
Tools	50	7.6	6	5.0	2.31
Vehicles	137	25.4	60	50.0	28.30*
Tractors	97	18.0	52	43.3	36.01*
Injury Event	1640		340		
Contact with objects	203	37.7	35	29.2	3.07
Struck by object	62	11.5	12	10.0	0.22
Caught in equipment	127	23.6	22	18.3	1.53
Falls	38	7.1	7	5.8	0.23
Fall to lower level	30	5.6	4	3.3	1.00
Bodily reaction	13	2.4	5	4.2	1.14
Exposure to substances	99	18.4	2	1.7	21.09*
Transportation	119	22.1	58	48.3	34.44*
Nonhighway accidents	80	14.8	34	28.3	12.49*
Pedestrian struck	24	4.5	13	10.8	7.54*
Fires and explosions	11	2.0	1	0.8	2.48†
Assaults	56	10.4	12	10.0	0.02
Animal assaults	52	9.7	11	9.2	0.03

\* p-value  $\leq 0.01$ .

† Fisher's exact test.

**Table 3. Injury cause (E-code), Kentucky**

Total	18-59 Years		60+ Years		$\chi^2$
	N	(%)	N	(%)	
Total	1640		340		
Machinery	334	20.4	98	28.8	11.1*
Tractor	83	5.1	30	8.8	7.41*
Animals	325	19.8	63	18.5	0.30
Falls	268	16.3	60	17.6	0.35
Knives, hand tools	165	10.1	24	7.1	2.94
Struck by object	139	8.5	26	7.6	0.25
Chain saw	58	3.5	9	2.6	0.68
Overexertion	108	6.6	9	2.6	7.86*
Other causes	243	14.8	51	15.2	0.01

\* p-value  $\leq 0.01$ .

related accidents, while one-third of the younger fatalities occurred with tractors (p-value = 0.03).

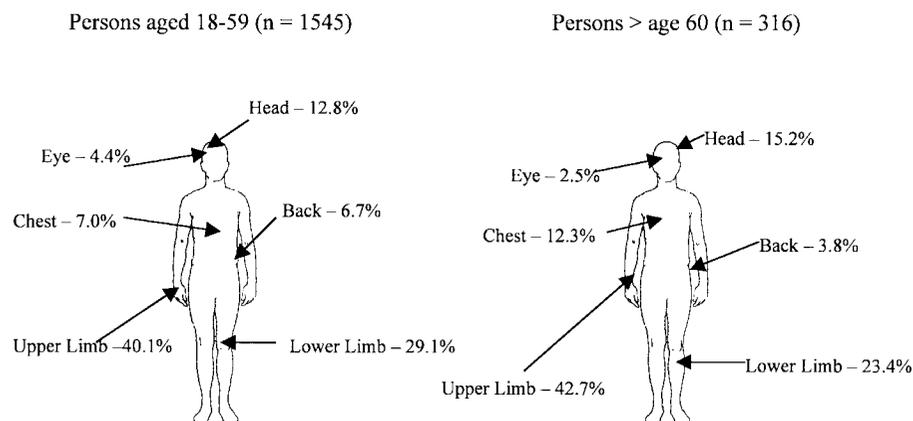


Figure 1—Body parts injured, Kentucky (n = 1861).

Table 4. Outcome of injury

	18-59 Years		60+ Years		$\chi^2$
	N	(%)	N	(%)	
New York State					
Total	539		120		
Fatal	61	11.3	39	32.5	34.21*
In-patient stay	238	44.2	68	56.7	6.18†
	Mean	S.D.	Mean	S.D.	T-Test
Time hospitalized	5.6	22	5.0	10	0.46
Work time lost	35	89	37.9	61	-0.41
Kentucky	N	(%)	N	(%)	$\chi^2$
Total	1640		340		
Fatal	12	0.7	15	4.5	28.54*
Transfer	46	2.8	15	4.5	2.49
In-patient stay	76	4.7	43	12.8	32.34*
Out patient	1499	91.8	264	78.3	53.79*

\* p-value  $\leq 0.01$ .

† p-value  $\leq 0.05$ .

## Discussion

Although New York and Kentucky have different types of farming, several similarities between characteristics of farm injuries to the elderly were noted. Because of differences in how these data were collected, a complete comparison between the states was not possible. Older farmers were at higher risk for tractor-related accidents. The injuries sustained by the elderly were also more severe, as shown by the much higher percentage who died as a result of their injuries or who were hospitalized. During 1994, in Kentucky and New York, 54% and 47%, respectively, of the farm tractor-related fatal incidents were to those older than 60 years (CDC, 1995; U.S. DOL, 1999). Several issues may be factors in why the elderly are at such high risk for any fatal injury on the farm including physical limitations, economic issues and behavior, as discussed below.

Overall, there is a slowing of the neural processes with age resulting in an increase in reaction time and diminished reflexes (Kenney, 1982). Specifically, overall reaction time is approximately 30% longer in older subjects, which may be a result of a small reduction in conduction velocity, joint stiffness and/or an increase in synaptic delay time. Illnesses such as arthritis, circulatory problems, and problems with sight, hearing, balance and gait may also be factors (N.Y.S. DOH, 1998b). Visual acuity is reduced especially with less illumination due to a decrease in the range of dilation and constriction. There is a decline in hearing sensitivity for higher frequencies. While the elderly are more susceptible to injuries as a result of falls (N.Y.S. DOH, 1994), it is interesting to note that falls resulting in injuries were reported less frequently among both of these older populations.

Economic factors may play a role in the injuries (Geller, 1990; Scharf, 1998). Most of the older farmers were owners or operators. Because farm owner-operators are interested in maximizing their productivity, costs for upgrading equipment are weighed against potential revenues (Scharf, 1998). Also, the owner's own labor is not calculated into these equations, often with the result of the owner doing whatever is necessary to increase productivity including working long hours and taking "short-cuts" (Scharf, 1998). Limited income may be a factor in their use of older equipment. Older equipment is less likely to have all of the necessary safety features including rollover protection systems and seatbelts, and investment in safety equipment or routine maintenance of equipment may be delayed due to economic constraints (Geller, 1990).

Behavior may also be a factor in the cause of injuries among the elderly. Many farmers may have developed unsafe work habits, but do not want to relearn how to perform a task (Scharf, 1998; Zhou, 1994, 1995). Other studies have shown that injured farmers often blame themselves for the accidents; however, they did not acknowledge that the injuries could be prevented (Zhou, 1994, 1995). These data agree with previous research suggesting farm owners and operators are more aware than farm workers of the usefulness of personal protective equipment and of safe chemical substitutions as seen by the significantly higher number of chemical exposure incidents among the younger farmers (N.Y.S. DOH, 1998b). Even though commodities differ in the two states, older farmers are consistently injured by machinery, which can result in more severe injuries.

One critical element lacking for the calculation of injury rates is specific data on exposures. The hours spent on a tractor prior to the injury, and the hours spent each week engaged in a specific farming activity, are unknown. Traditionally, injuries are expressed by hours worked which allow for the estimation of the relative risk of particular activities. Because the hours worked varies so greatly by season, scale of farming operation, whether the farmer works part-time, full-time or is bi-vocational, the causes of injuries cannot be compared with each other nor can their risks be evaluated. Similarly, establishing injury rates with confidence is not possible because the total at risk population is unknown. In addition, not all of those injured were performing work at the time of the injury. For example, an injury may have occurred on an ATV as the farmer was taking a recreation ride about the farm. Removing all recreation incidents from the Kentucky data ( $n = 109$ ) did not change the results.

These data confirm the need to standardize data collection tools and definitions, and to combine injury data where appropriate. It is important to compare the injuries identified by all of the states in the OHNAC program to national estimates in order to determine whether the estimates are accurate. In spite of differing methodologies, this would foster validity checks on national estimates.

Significant differences are noted between Kentucky and New York's data and the national estimates for those 60 and over in the body parts injured (Myers, 1998). Kentucky identified more head/neck, eye, chest/trunk and upper limb injuries and fewer lower limb, and back injuries. Also, significantly more machinery injuries were recorded for both New York and Kentucky than national estimates. Kentucky had fewer livestock injuries than the national lost time injury estimates for this age group, but New York had many more livestock injuries.

According to the Agricultural Census, approximately 35% of older farm owners and operators in New York work on dairy farms (U.S. DA, 1999); however, 54% of the older farmers in the data collected by the OHNAC nurses worked on dairy farms. It is not expected that a higher percentage of injuries occurred among the elderly on dairy farms, but rather that the data is biased towards dairy farms due to the data collection techniques.

Unlike many other occupations, farmers continue to work beyond typical retirement age. It is unknown which farming tasks are ceased at what age, for what reason and under what circumstances. Research has been done on how farming youth begin gradually taking on more difficult and potentially dangerous tasks (National Committee for Childhood Agricultural Injury Prevention, 1996), but there is no research on how certain tasks are discontinued as a person gets older. Nor is it known why people continue to farm. It is possibly due to economics, or that nobody may be available to take on the tasks. But it may also be due to the desire to feel a sense of accomplishment, self worth and independence, or that a lifetime of physical labor is too difficult to change as a farmer gets older. Further research is needed in this area.

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