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## Characterization of Agricultural Tasks Performed by Youth in the Keokuk County Rural Health Study

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Injury and illness among youth working on farms are important problems. The types of farm tasks performed by children and the ages at which they begin these activities have not been well characterized. This cross-sectional study characterized agricultural work performed by adolescents in a rural Iowa county to better understand the patterns and extent of exposures to agricultural risk factors. This information will help to develop prevention strategies for agriculture-related injury and illnesses for children working on farms. The Keokuk County Rural Health Study is a prospective cohort study of randomly selected households in Iowa. In Round 2, all youth, aged 12 to 17 years participating in this population-based study, were asked about their use of farm machinery, work with livestock, pesticide handling, and other farm activities. The age at which they actually began these activities, the age they believed youth should start these activities, and sources of health and safety training they received were also ascertained. Adults in the study were asked the same questions about youth. Matched parental reports and opinions were compared to their children's reports and opinions using McNemar's chi-square tests. A total of 143 youth and 684 adults with farming experience completed the interviews. There were 118 pairs of parents and youth. Fifty percent of male youth, and 18 percent of females had performed agricultural work at some time in their life. Twenty-five percent of all male youth, and 5 percent of females were currently working on farms. Close to 30 percent had driven tractors, all-terrain vehicles, and pick-up trucks. Despite the legal prohibition of hazardous work by children under age 16, several younger children reported that they had driven a self-propelled combine, worked in silos, or handled and applied fertilizers in the past 12 months. Youth began riding on tractors at a mean age of 7. The mean ages for driving tractors and all-terrain vehicles were 11 and

10, respectively. The mean age for driving a self-propelled combine was 13. Children began applying or handling fertilizers at the age of 12. There were discrepancies between parent and youth reports regarding the frequencies, starting age, and opinions relative to performing agricultural tasks. These results suggest the need for implementing guidelines, particularly for age appropriate agricultural tasks.

**Keywords** Agriculture, Children, Youth, Task, Age

Agriculture remains one of the most dangerous occupations in the United States, although the farm injury death rate has been reduced.<sup>(1)</sup> In recent years, greater attention has been focused on the problem of agriculture-related injuries and illnesses among youth living and working on farms in the United States. Young people make up a substantial portion of the agricultural workforce in this nation. An estimated 262,000 youth, 16–19 years of age, were employed in agriculture, forestry, and fishing in 1996.<sup>(2)</sup>

Considering farm family residents, visitors, and children of seasonal or migrant workers, more than 2 million youth less than 20 years of age are exposed to farm hazards each year.<sup>(3)</sup> Young people who work on farms are at risk for injuries and illness because of the hazardous nature of agricultural work and the lack of regulation.<sup>(4)</sup> National Center for Health Statistics Mortality Data files documented nearly 2200 fatalities among youth on farms between 1982 and 1996.<sup>(3)</sup> The major causes of unintentional death were farm machinery, drowning, and firearms. The South and Midwest regions of the United States accounted for almost 80 percent of the fatal farm injuries reported.

According to Castillo et al.,<sup>(5)</sup> from 1980 to 1989, at least 110 of 670 occupation-related fatally injured youth worked in agriculture, forestry, or fishing. The production agriculture fatality rate for young workers during 1990 through 1993 was

12 deaths/100,000 workers based on the National Traumatic Occupational Fatalities surveillance (NTOF) compared to 4.4/100,000 for all private sector workers. The rate from the Census of Fatal Occupational Injuries (CFOI) for the years 1992–1995 was 16.6 deaths/100,000 young workers compared to 5/100,000 for all U.S. private-sector workers. Both surveillance systems indicated that young production agricultural workers have a threefold greater risk of death than private-sector workers nationally.<sup>(6)</sup>

Child labor laws for agriculture are woefully weak. The legal age limit for work on larger farms, which are covered under the Fair Labor Standard Act, is 12 years.<sup>(7)</sup> In reality, children often start farm work before that legal age. Farmers reported they were quite likely to allow children 10 to 14 years old to drive a tractor, and less likely to allow a child near a dairy cow or be an extra rider on a tractor without a cab.<sup>(8)</sup> A survey by *Successful Farming* magazine showed that almost 30 percent of farm boys are driving tractors at ages 7–9, and 95 percent are riding on tractors by that age.<sup>(9)</sup> Farm injuries among young workers have been recognized as a public health concern.<sup>(10)</sup> However, there have been few studies of children's agricultural work and associated hazards. Also, comprehensive analysis of agricultural tasks for youth has not been conducted since employment data are not routinely collected or published for youth younger than 15 years old.

The goal of this study was to characterize agricultural tasks performed by youth in a rural Iowa county. The purpose was to better understand the patterns and extent of exposures to agricultural risk factors, and to help develop prevention strategies for agriculture-related injury and illnesses for children working on farms.

## METHODS

### Study Design and Population

The Keokuk County Rural Health Study (KCRHS) is a population-based, prospective study of health status and environmental exposures of a large stratified random sample of 1004 households in one rural Iowa county. Descriptions of Keokuk County and the KCRHS including details of the sampling scheme have been previously published.<sup>(11–13)</sup> Participants include those living on farms and those living in town and in non-farm, non-town (rural) households. This article reports data on agricultural tasks performed by youth, aged 12 to 17 years, for Round 2 collected between April 1999 and April 2002. Both youth and adults, 18 years and older, were interviewed in person and asked specific questions about children's current agricultural tasks, the age at which they started, and their opinion regarding these tasks. Youth and parents were interviewed separately.

One hundred forty-three youths responded, and 118 adults, matched with youths by household, also responded about the agricultural work of their children. Overall, 684 adults with agricultural experience provided opinions concerning appropriate ages for starting agricultural tasks. Responses from adults

without agricultural experience were not included in these analyses. No participant refused to answer these questions. Interviews were conducted by a single trained interviewer, except when absent because of vacation or illness. Duplicate interviews were conducted and compared for a subset of respondents to ensure reliability.

### Study Variables

The following questions concerning children's agricultural work were asked of youth. First, "Have you ever worked around farm equipment or in a farm setting for at least 10 hours per week for one year or for 1 month out of a year, either for pay or not for pay?" Second, "Are you currently doing any farm work for 10 hours or more per week?" These criteria were established to define significant work in agriculture. Tasks such as driving a tractor or all-terrain vehicle, baling hay, livestock chores, or handling pesticides were also surveyed. For all agricultural tasks the current frequency and the age at which youth started doing the tasks were ascertained. Opinions concerning the appropriate age to begin these tasks, and whether boys and girls should perform farm tasks at different ages were also recorded. Copies of the adult and youth questionnaires are included as Appendixes 1 and 2.

### Statistical Methods

A cross-sectional analysis of the prevalence of agricultural work and each agricultural task among youths was performed. The frequency of current agricultural activities reported by youth was compared to that reported by matched parents using McNemar chi-square tests, and the starting age for agricultural tasks reported by youth was compared to that reported by matched parents using paired t-tests. Opinions of youth were compared to opinions of adults using Chi-square tests and t-tests. All analytic procedures were conducted with SAS version 6.12, using a 0.05 level for statistical significance.<sup>(14)</sup>

## RESULTS

### Agricultural Tasks Performed

Thirty-four percent of all youths aged 12–17 years (combined over all three types of residence) had performed agricultural work at some time in their life. Among males, 86.7 percent of those living on farms had performed agricultural work, while 38.9 percent of rural and 21.9 percent of town youth had ever worked on farms. For females the proportions were 21 percent for farm residents, 10.5 percent of rural residents and 12 percent of town residents. Sixteen percent of the youth in this sample were currently working on farms. Again, there were differences by residence, with 60 percent of farm males, 5.6 percent rural males, and 3.1 percent town males currently working on farms. Sixteen percent of farm females were currently performing agricultural tasks, while no town or rural females were currently engaged in agricultural work.

**TABLE I**

Keokuk County Rural Health Study youth ages 12–17 who have worked at least 10 hours per week for one year, or for one month, by sex and age

Sex	Ever have worked <sup>A</sup> n (%)	Currently working n (%)
Male (n = 80)	40 (50.0) <sup>B</sup>	20 (25.0) <sup>B</sup>
Female (n = 63)	9 (18.4)	3 (4.8)
Age (year)		
12 (n = 23)	9 (39.1)	5 (21.8)
13 (n = 24)	7 (29.1)	3 (12.5)
14 (n = 24)	4 (16.6)	1 (4.4)
15 (n = 26)	10 (38.5)	5 (19.2)
16 (n = 23)	10 (52.2)	6 (26.1)
17 (n = 23)	7 (30.4)	3 (13.0)

<sup>A</sup>Includes current.

<sup>B</sup>p < 0.01 (tests for difference in proportions of males and females).

Table I presents the frequency of participation in agricultural work among youths by sex and age. Figure 1 shows the frequency of agricultural work in the past 12 months by each task. Over 25 percent of youths had driven all-terrain vehicles and over 30 percent had driven a pick-up truck. Eight youths reported driving a self-propelled combine, 5 worked in silos, 14 handled fertilizers or pesticides, and 4 applied fertilizers or pesticides.

Table II presents the frequency of agricultural tasks ever performed by youth. Close to 30 percent of youths had driven a tractor, pick-up truck, or all-terrain vehicle, or ridden on a tractor as an extra passenger. One-quarter performed chores around cows and hogs. Less than 20 percent reported had driven a self-

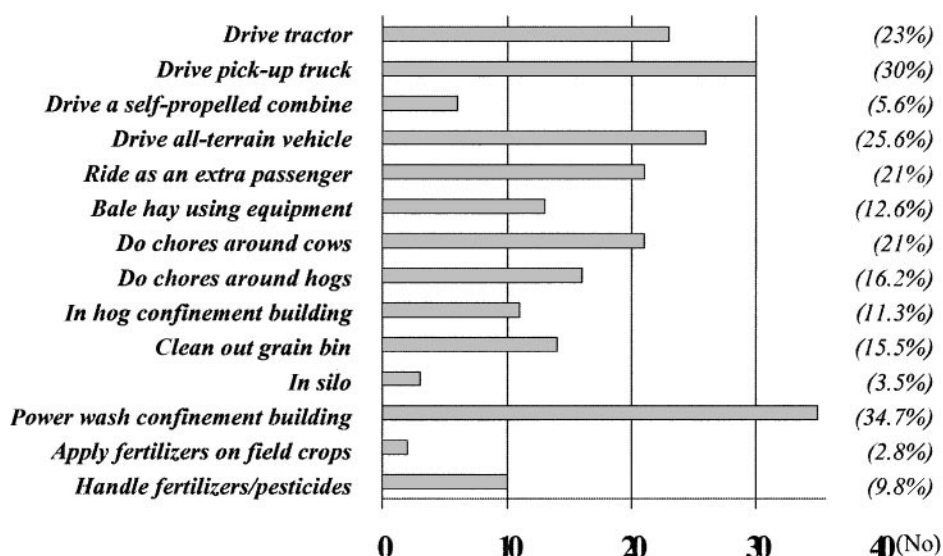
propelled combine, worked in a silo, or applied and handled fertilizers or pesticides. In all cases a higher proportion of boys reported performing farm work than girls.

Table III shows the frequency of work on farms reported by youths compared to parents matched by household. Although there were disagreements in all categories, statistically significant differences in reporting were found for driving tractors, pick-up trucks, all terrain vehicles, and for riding as an extra passenger on a tractor (McNemar p-value < 0.001). Parents indicated these activities occurred much more frequently.

Only a small proportion of youth felt that children should not perform agricultural work. Seventeen percent said that children should not drive a self-propelled combine, and about 24 percent answered they should not apply and handle fertilizers. Cleaning out grain bins, working in silos, or riding as an extra passenger on tractors were noted by about 12 percent. There were no gender differences in youth opinions. The percentage of children who believed that they should not do a particular task was higher than the parent opinions.

### The Age for Starting Agricultural Tasks

Table IV shows the comparison of the starting age reported for each agricultural task by matched youths and parents. Compared to the age that children reported, parents gave similar responses except for driving a tractor, pick-up truck, all-terrain vehicle, or doing chores around cows. Parents reported children starting at older ages. At the mean age of 6½ years, children had started riding on a tractor. At 8½ years, they began to do chores around livestock. At 9 to 11 years, they drove all-terrain vehicles, tractors, or trucks, and worked in confined livestock buildings. At 12 to 13 years, they had started to drive self-propelled combines, work in silos, and apply pesticides.

**FIGURE 1**

The frequency of agricultural work in the past 12 months by task reported by youth aged 12–17 years (n = 117).

**TABLE II**  
Frequency of ever performing agricultural work by each task and sex reported by youths aged 12–17 years

Youth's agricultural tasks	Male (n = 80) n (%)	Female (n = 63) n (%)	Total (n = 143) n (%)
Drive a tractor <sup>A</sup>	34 (42.5)	7 (11.1)	41 (28.7)
Drive a pick-up truck <sup>A</sup>	38 (47.5)	8 (12.7)	46 (32.2)
Drive a self-propelled combine <sup>B</sup>	8 (10.0)	1 (1.6)	9 (6.3)
Drive an all-terrain vehicle <sup>A</sup>	36 (45.0)	5 (7.9)	41 (28.7)
Ride as an extra passenger on a tractor <sup>A</sup>	31 (41.3)	8 (12.7)	39 (28.3) <sup>D</sup>
Bale hay or straw using equipment <sup>A</sup>	24 (30.0)	4 (6.4)	28 (19.6)
Do chores around cows <sup>A</sup>	29 (36.2)	7 (11.1)	36 (25.2)
Do chores around hogs <sup>A</sup>	32 (40.0)	6 (9.5)	38 (26.6)
Work in hog confinement building <sup>A</sup>	21 (26.6)	2 (3.2)	23 (16.2) <sup>E</sup>
Clean out grain bin <sup>A</sup>	25 (31.6)	0 (0.0)	25 (17.6) <sup>E</sup>
Work in silo <sup>B</sup>	5 (6.2)	0 (0.0)	5 (3.5)
Work in power wash confinement buildings <sup>A</sup>	20 (25.0)	2 (3.2)	22 (15.4)
Apply fertilizers or pesticides on field crops <sup>B</sup>	5 (6.2)	0 (0.0)	5 (3.5)
Handle fertilizers or pesticides <sup>C</sup>	16 (20.0)	2 (3.2)	18 (12.6)

<sup>A</sup>p < 0.001 (tests for difference in proportions by gender).

<sup>B</sup>p < 0.05.

<sup>C</sup>p < 0.01.

<sup>D</sup>N = 138.

<sup>E</sup>N = 142.

**TABLE III**  
Agreement between youth and parent reports of ever performing agricultural work by each task (n = 118 pairs)

Youth's agricultural task	Both youth and parent, yes (n, [%])	Only youth, yes (n, [%])	Only parent, yes (n, [%])	Both youth and parent no (n, [%])
Drive a tractor <sup>A</sup>	29 (25.4)	5 (4.4)	17 (15.0)	63 (55.3)
Drive a pick-up truck <sup>B</sup>	35 (30.4)	2 (1.7)	39 (34.0)	39 (34.0)
Drive a self-propelled combine	3 (2.6)	4 (3.7)	3 (2.6)	105 (91.3)
Drive an all-terrain vehicle <sup>B</sup>	29 (26.4)	4 (3.6)	41 (37.3)	36 (32.7)
Ride as an extra passenger on a tractor <sup>B</sup>	23 (22.3)	6 (5.8)	34 (33.0)	40 (38.8)
Bale hay or straw using equipment	11 (9.6)	10 (8.8)	7 (6.1)	86 (75.4)
Do chores around cows	21 (18.3)	10 (8.7)	12 (10.4)	72 (62.6)
Do chores around hogs	21 (18.4)	9 (7.9)	13 (11.4)	71 (62.3)
Work in hog confinement building	9 (8.0)	8 (7.1)	8 (7.1)	87 (77.7)
Clean out grain bin	12 (10.5)	10 (8.7)	7 (6.1)	85 (74.6)
Work in silo	1 (0.9)	4 (3.5)	2 (1.8)	107 (93.9)
Work in power wash confinement buildings	9 (8.0)	8 (7.1)	6 (5.3)	90 (79.6)
Apply fertilizers or pesticides on field crops	0 (0.0)	4 (3.4)	4 (3.4)	108 (93.1)
Handle fertilizers or pesticides	6 (5.2)	9 (7.8)	4 (3.4)	97 (83.6)

<sup>A</sup>p < 0.05.

<sup>B</sup>p = 0.001 by McNemar's Test.

Note: Each child's response was paired with his/her male guardian when available. If a response from the adult male guardian was not available, the responses of the adult female guardian were used.

**TABLE IV**  
Comparison of youth versus parent reports concerning when youths began performing agricultural tasks  
(based on 118 matched pairs)

	Youths		Adults	
	n	Age (mean $\pm$ sd)	n	Age (mean $\pm$ sd)
Drive a tractor <sup>A</sup>	36	10.5 $\pm$ 2.5	46	11.7 $\pm$ 2.4
Drive a pick-up truck <sup>B</sup>	39	11.2 $\pm$ 2.5	74	12.6 $\pm$ 2.0
Drive a self-propelled combine (ns)	7	13.1 $\pm$ 2.3	6	13.3 $\pm$ 2.6
Drive an all-terrain vehicle <sup>A</sup>	35	9.2 $\pm$ 2.8	70	10.7 $\pm$ 2.9
Ride as an extra passenger on a tractor (ns)	33	6.5 $\pm$ 3.5	62	7.2 $\pm$ 3.7
Bale hay or straw using equipment (ns)	23	10.6 $\pm$ 2.3	18	11.7 $\pm$ 2.0
Do chores around cows <sup>A</sup>	31	8.8 $\pm$ 2.6	33	10.0 $\pm$ 2.1
Do chores around hogs (ns)	32	8.2 $\pm$ 3.2	34	9.4 $\pm$ 3.2
Work in hog confinement building (ns)	18	10.8 $\pm$ 3.8	17	9.3 $\pm$ 3.9
Clean out grain bin (ns)	23	10.5 $\pm$ 2.4	19	11.6 $\pm$ 3.1
Work in silo (ns)	5	12.0 $\pm$ 3.1	3	12.7 $\pm$ 4.2
Work in power wash confinement buildings (ns)	19	12.0 $\pm$ 2.8	15	11.7 $\pm$ 2.9
Apply fertilizers or pesticides on field crops (ns)	4	10.5 $\pm$ 1.9	4	13.0 $\pm$ 1.4
Handle fertilizers or pesticides (ns)	16	12.2 $\pm$ 3.0	10	12.6 $\pm$ 1.9

ns = not significant.

<sup>A</sup>p < 0.05.

<sup>B</sup>p < 0.001 (tests for difference between parent and child).

**TABLE V**  
Youth opinions concerning the appropriate age for starting agricultural tasks

	Male (n = 80)		Female (n = 63)	
	n (%)	Age (mean $\pm$ sd)	n (%)	Age (mean $\pm$ sd)
Drive a tractor <sup>A</sup>	70 (87.5)	12.4 $\pm$ 2.4	56 (88.9)	13.4 $\pm$ 2.0
Drive a pick-up truck <sup>A</sup>	74 (92.5)	13.3 $\pm$ 2.0	61 (96.8)	14.1 $\pm$ 1.8
Drive a self-propelled combine	57 (71.2)	14.3 $\pm$ 2.1	47 (74.6)	14.9 $\pm$ 1.5
Drive an all-terrain vehicle	72 (90.0)	11.8 $\pm$ 3.0	55 (87.3)	11.9 $\pm$ 2.7
Ride as an extra passenger on a tractor	64 (80.0)	8.5 $\pm$ 4.0	47 (74.6)	8.6 $\pm$ 3.7
Bale hay or straw using equipment <sup>B</sup>	66 (82.5)	12.4 $\pm$ 2.1	50 (79.4)	13.6 $\pm$ 2.0
Do chores around cows <sup>A</sup>	74 (92.5)	10.0 $\pm$ 2.2	49 (77.8)	10.8 $\pm$ 2.4
Do chores around hogs <sup>A</sup>	72 (90.0)	10.0 $\pm$ 2.4	56 (88.9)	11.1 $\pm$ 2.4
Work in hog confinement building	68 (85.0)	11.9 $\pm$ 2.8	44 (69.8)	12.8 $\pm$ 2.7
Clean out grain bin	64 (80.0)	12.3 $\pm$ 2.5	48 (76.2)	12.8 $\pm$ 2.4
Work in silo	54 (67.5)	13.2 $\pm$ 2.2	38 (60.3)	13.0 $\pm$ 2.4
Work in power wash confinement buildings	68 (85.0)	12.1 $\pm$ 2.4	47 (74.6)	12.9 $\pm$ 2.2
Apply fertilizers or pesticides on field crops	54 (67.5)	14.9 $\pm$ 1.6	42 (66.7)	15.0 $\pm$ 1.5
Handle fertilizers or pesticides	55 (68.8)	14.7 $\pm$ 1.8	46 (70.3)	15.0 $\pm$ 1.7

ns = not significant.

<sup>A</sup>p < 0.05.

<sup>B</sup>p < 0.001 (tests for difference between gender).

**TABLE VI**

Comparison of adults with agricultural work experience versus youths' opinions concerning the appropriate age for starting agricultural tasks

	Adults (n = 684)		Youths (n = 143)	
	n (%)	Age (mean $\pm$ sd)	n (%)	Age (mean $\pm$ sd)
Drive a tractor (ns)	643 (94.0)	12.5 $\pm$ 2.0	126 (88.1)	12.9 $\pm$ 2.3
Drive a pick-up truck (ns)	649 (94.8)	13.7 $\pm$ 1.8	135 (94.4)	13.7 $\pm$ 2.0
Drive a self-propelled combine <sup>A</sup>	463 (67.7)	15.2 $\pm$ 1.4	104 (72.7)	14.6 $\pm$ 1.9
Drive an all-terrain vehicle <sup>A</sup>	575 (84.1)	12.7 $\pm$ 2.7	127 (88.8)	11.9 $\pm$ 2.8
Ride as an extra passenger on a tractor (ns)	378 (55.3)	8.9 $\pm$ 3.6	111 (77.6)	8.6 $\pm$ 3.9
Bale hay or straw using equipment <sup>A</sup>	526 (76.9)	14.3 $\pm$ 1.9	116 (81.15)	13.0 $\pm$ 2.2
Do chores around cows <sup>A</sup>	631 (92.2)	11.4 $\pm$ 2.4	131 (91.6)	10.4 $\pm$ 2.3
Do chores around hogs <sup>A</sup>	620 (90.6)	11.6 $\pm$ 2.4	128 (89.5)	10.5 $\pm$ 2.4
Work in hog confinement building (ns)	415 (60.7)	12.4 $\pm$ 2.5	112 (78.3)	12.3 $\pm$ 2.8
Clean out grain bin <sup>A</sup>	468 (68.4)	13.6 $\pm$ 2.4	112 (78.3)	12.5 $\pm$ 2.5
Work in silo <sup>A</sup>	328 (48.0)	14.4 $\pm$ 2.0	92 (64.3)	13.2 $\pm$ 2.2
Work in power wash confinement buildings <sup>A</sup>	492 (71.9)	13.3 $\pm$ 2.2	115 (80.4)	12.4 $\pm$ 2.4
Apply fertilizers or pesticides on field crops <sup>A</sup>	247 (36.1)	15.6 $\pm$ 1.0	96 (67.1)	15.0 $\pm$ 1.5
Handle fertilizers or pesticides <sup>A</sup>	235 (34.4)	15.6 $\pm$ 1.1	101 (70.6)	14.9 $\pm$ 1.8

ns = not significant.

<sup>A</sup>p < 0.001 (tests for difference between adults and youth).

Table V shows youth opinions concerning the appropriate age for starting agricultural tasks. In general, girls indicated slightly older ages for all tasks. Youth answered that the appropriate age for riding as a passenger on a tractor was 8 1/2; The appropriate age for doing chores around livestock was 10; and for driving tractors, trucks, and all-terrain vehicles were 12–14. The age for driving a self-propelled combine and applying or handling fertilizers was 15, according to the youth who answered.

Table VI presents the comparison of youth and parent opinions concerning the age for starting agricultural tasks. Compared to youths, the ages parents gave were older and these differences

of opinion were statistically significant for almost all categories. Also, both parents and youth thought children should begin farm work at older ages than they actually did for almost every category. These differences between actual practice and opinion were statistically significant.

Table VII shows youth and adult opinions concerning whether the age children should be allowed to start farm work should be different for boys and girls. A large proportion of both youth and adults thought the age at which children are allowed to start farm work should be different for boys and girls, and most of them answered that boys should start at a younger age than girls.

**TABLE VII**

Youth and parent opinions concerning whether the age children are allowed to start farm work should be different for boys and girls

The opinion about the age children are allowed to start farm work	Youth (n = 143)	Parents (n = 199) <sup>A</sup>
	n (%)	n (%)
The age children are allowed to start farm work should be different		
Yes	34 (24.0)	32 (15.8)
No	104 (72.5)	164 (80.8)
Don't know	8 (3.5)	3 (3.4)
Start farm work at a younger age		
Girls	2 (5.8)	0 (0.0)
Boys	31 (91.3)	31 (96.9)
Don't know	1 (2.9)	1 (3.1)

<sup>A</sup>Includes all parents.

## DISCUSSION

A high proportion of youth in this population frequently participated in agricultural work. Thirty-four percent, regardless of residential status, had worked around farm equipment or in a farm setting at some point in their life. Sixteen percent were currently doing farm work for ten hours or more per week. In addition, other youth, while not working regularly on a farm, had performed numerous farm tasks within their lifetime. Children in this study performed a full range of farm activities, similar to findings among North Carolina teens.<sup>(4)</sup> Schulman et al.<sup>(4)</sup> found that North Carolina teens who had ever worked on farms had been exposed to tractors, heavy machinery, large animals, pesticides, power tools, and weapons.

Farm tractors are powerful machines intended for operation by adults<sup>(15)</sup> and are also implicated most frequently in childhood agricultural fatalities.<sup>(3,6-8,16,17)</sup> Tractors account for 44 percent of the machine-related deaths among youths.<sup>(5)</sup> Extra riders on tractors may fall off and get run over by the tractor wheels or the trailing implement.<sup>(15)</sup>

Pesticides are also thought to pose a considerably higher risk to children than to adults.<sup>(7)</sup> In addition to the possible increased toxicity, personal protective equipment that would help limit exposure is not designed to fit the body dimensions of most children. Despite the consensus prohibition of hazardous work by children under age 16,<sup>(18)</sup> a significant proportion of youths in this sample reported that they had at some time driven a self-propelled combine, worked in a silo, or applied and handled fertilizers or pesticides.

Most studies of children in agriculture have depended on interviews with parents. In this study there were discrepancies between parent and child reports concerning both the frequency at which farm tasks were performed and the age at which they began. These large differences in reporting suggest the possibility that youth perform farm tasks without parents' consent or guidance even though they are at an age needing parents' consent or guidance. Parents may also under-report the farm work of their children because of a sense that children should not be doing this work. Alternatively, children may under- or over-report. It is possible that youth may view performance of certain tasks as an indication of maturity and claim to regularly do work that is actually done infrequently. Also, parent and child perception of time are likely to be different and the recall of age when specific tasks were started may be biased. This study did not contain control questions, such as other life events, to evaluate differences in time perception.

Farm machinery is intended for operation by adults, and keeping children away from operating equipment requires supervision by parents.<sup>(15)</sup> According to the North American Guideline for Children's Agricultural Tasks (NAGCAT),<sup>(18)</sup> children aged 12 to 13 should be limited to operating tractors of less than 20 horsepower and should be watched nearly constantly. This guideline also recommends that children aged 14–15 should be checked every few minutes at first, but could be left for 15 to 30 minutes when they can do the job, while children 16 or older

may be left for 15 to 30 minutes when they can do the job. According to the NAGCAT guideline, children under 16 should not drive a self-propelled combine and children under 14 should not work in a silo.

However, youth in this study may have started some hazardous farm tasks at an early age without parents' guidance. Hawk et al.<sup>(19)</sup> reported that 91 percent of boys and 44 percent girls in the 15–18 year-old group and 59 percent of boys and 16 percent of girls in the 10–14 year old group operated tractors alone without supervision.

Although the Department of Labor-regulated age for hazardous work on farms is 16, and the minimal required age limit to begin farm work is 14, there are many exemptions. Minors aged 12 and 13 may be employed if the job is on the same farm where the parents are employed, or with written consent of the parents. Businesses with annual sales below \$500,000 are also exempt from coverage under the Fair Labor Standard Act.<sup>(20)</sup> Therefore, children at any age may legally do agricultural tasks.<sup>(5)</sup> How old and mature children should be before they are ready to help with farm work and can safely operate machines or vehicles is a question with many answers, depending on who is asked. The North American Guideline for Children's Agricultural Tasks,<sup>(18)</sup> developed by a task force including experts in agricultural health and safety and child development, provides consensus on the level of supervision needed for specific tasks and specific ages. These recommendations are based on the typical cognitive abilities and motor skills, as well as physical size of children at various ages. The guidelines, however, do not specify ages at which it would be appropriate for children to begin these tasks. Clearly, development of more specific age and human factors requirements would be useful.

Communication of this type of information through formal training is considered conducive to reducing the incidence of injury among children.<sup>(5)</sup> In particular, farm family seminars have proven to be a good way to encourage family groups to learn about the dangers on the farm.<sup>(22)</sup> In this study only 20 percent of youths reported having received formal farm safety training. Also, many youth did not recognize hazards of certain farm tasks. For example, no youth of any age said they should not drive a pick-up truck or do chores around cows. The proportion of boys and girls who believe that children should not do specific tasks was lower than the proportion of parents. Compared to parents, youth thought that they should start agricultural tasks at a younger age.

The sources of training were limited to farm safety day camps, 4-H or FFA programs, and extension service. While medical providers and veterinarians were rated highly by farmers for integrity of information,<sup>(21)</sup> they were not used by this population as a source of information/training.

## CONCLUSION

Children under 18 years are exposed to risk for injury and disease through participation in dangerous farm work. Similar to



the few studies in other parts of the United States, children in this study operated heavy farm machinery, worked with livestock, and handled pesticides beginning as early as 6 to 8 years. Males were more likely than females to have ever worked on a farm, and more 15- and 16-year-olds performed farm work than those in other age groups. Disparities between parent and youth reports indicate that other studies relying on adults may not be accurately reporting the extent of youth participation in agricultural work.

There is a need to better characterize the risk factors experienced by youth working in the U.S. agricultural industry, including industrial hygiene assessment of exposures. There is also a need to further develop and implement guidelines including age and human factors requirements for children working in agriculture. The high proportion of children without farm safety training reinforces the need for implementation of organized farm safety training. Effective intervention should include training of both parents and children. Efforts to facilitate alternative interventions through engaging medical providers, veterinarians, and industrial hygienists should be encouraged.

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**APPENDIX 1. ADULT QUESTIONNAIRE—Children's Agricultural Tasks**

1A. Do you have any children 5–17 years old living in this household?

1 Yes 2 No GO TO Introduction to Question 23

1B. Is there a boy or a girl or both in this household?

1 A boy only 2 A girl only 3 A boy and a girl

[Ask questions 2–12 about oldest male child AND questions 13–22 about oldest female child.]

\*“BEHAVIOR” QUESTIONS (2–22) ARE ASKED FIRST IN THE MORNING.

“ATTITUDE” QUESTIONS (23–33) ARE ASKED FIRST IN THE AFTERNOON.

\*QUESTIONS ABOUT MALE CHILD ARE ASKED FIRST ON ODD DAYS

QUESTIONS ABOUT FEMALE CHILD ARE ASKED FIRST ON EVEN DAYS\*

Now I am going to ask you some questions about any farm work your children may do.

{PERIOD} # 1 = MORNING 2 = AFTERNOON

{DAY} # 1 = ODD DAYS 2 = EVEN DAYS

Think about YOUR OLDEST SON. How old was he the first time he did each of the following activities:

- 2... drive a tractor? ## years old 98 Don't know 99 Has not done this yet
- 3... drive a pick-up truck? ## years old 98 Don't know 99 Has not done this yet
- 4... ride as an extra passenger on a tractor? ## years old 98 Don't know 99 Has not done this yet
- 5... drive a self-propelled combine? ## years old 98 Don't know 99 Has not done this yet
- 6... drive an all-terrain vehicle? ## years old 98 Don't know 99 Has not done this yet
- 6a... bale hay or straw using equipment? ## years old 98 Don't know 99 Has not done this yet
- 7... do chores around cows? ## years old 98 Don't know 99 Has not done this yet
- 8... do chores around hogs? ## years old 98 Don't know 99 Has not done this yet
- 8a... work in hog confinement building? ## years old 98 Don't know 99 Has not done this yet
- 8b... clean out grain bin? ## years old 98 Don't know 99 Has not done this yet
- 8c... work in silo? ## years old 98 Don't know 99 Has not done this yet
- 8d... power wash confinement buildings? ## years old 98 Don't know 99 Has not done this yet
- 9... apply fertilizers or pesticides on field crops? ## years old 98 Don't know 99 Has not done this yet
- 10... handle fertilizers or pesticides; for example, carry containers or mix solutions? ## years old 98 Don't know 99 Has not done this yet
- 11... Has (child's name) had any organized farm safety training?
  - 1 Yes
  - 2 No GO TO Question 13
  - 8 Don't know GO to Question 13
- 12... Did he receive any organized farm safety training from any of the following: [LIST 57]
  - 1 Yes 2 No 8 Don't know

{Ag12BA} # Veterinarian

{Ag12BB} # Extension service

{Ag12BC} # University medical school

{Ag12BD} # Vo-Ag program (community college)

{Ag12BE} # Insurance company

{Ag12BF} # Farm or commodity organization

{Ag12BG} # Local farm chemical or feed supplier

{Ag12BH} # Local farm equipment dealer

{Ag12BI} # 4-H or FFA program

{Ag12BJ} # Farm safety day camp

{Ag12BK} # Other farmers

{Ag12BL} # Other organization Specify: {Ag12Bo} <A >

Think about YOUR OLDEST DAUGHTER. How old was she the first time she did each of the following activities on a farm:

- 13... drive a tractor? ## years old 98 Don't know 99 Has not done this yet
- 14... drive a pick-up truck? ## years old 98 Don't know 99 Has not done this yet

- 15... ride as an extra passenger on a tractor? ## years old 98 Don't know 99 Has not done this yet  
 16... drive a self-propelled combine? ## years old 98 Don't know 99 Has not done this yet  
 17... drive an all-terrain vehicle? ## years old 98 Don't know 99 Has not done this yet  
 17a... bale hay or straw using equipment? ## years old 98 Don't know 99 Has not done this yet  
 18... do chores around cows? ## years old 98 Don't know 99 Has not done this yet  
 19... do chores around hogs? ## years old 98 Don't know 99 Has not done this yet  
 19a... work in hog confinement building? ## years old 98 Don't know 99 Has not done this yet  
 19b... clean out grain bin? ## years old 98 Don't know 99 Has not done this yet  
 19c... work in silo? ## years old 98 Don't know 99 Has not done this yet  
 19d... power wash confinement buildings? ## years old 98 Don't know 99 Has not done this yet  
 20... apply fertilizers or pesticides on field crops? ## years old 98 Don't know 99 Has not done this yet  
 21... handle fertilizers or pesticides; for example, carry containers or mix solutions? ## years old 98 Don't know  
 99 Has not done this yet  
 22. Has (child's name) had any organized farm safety training?  
 1 Yes  
 2 No GO TO Question 23  
 8 Don't know GO to Question 23  
 22a. Did she receive any organized farm safety training from any of the following:  
 1 Yes 2 No 8 Don't know

{Ag22GA} # Veterinarian  
 {Ag22GB} # Extension service  
 {Ag22GC} # University medical school  
 {Ag22GD} # Vo-Ag program (community college)  
 {Ag22GE} # Insurance company  
 {Ag22GF} # Farm or commodity organization  
 {Ag22GG} # Local farm chemical or feed supplier  
 {Ag22GH} # Local farm equipment dealer  
 {Ag22GI} # 4-H or FFA program  
 {Ag22GJ} # Farm safety day camp  
 {Ag22GK} # Other farmers  
 {Ag22GL} # Other organization Specify: {Ag22Go} <A >

[Questions 23–33 should be asked of all adults currently living or working on a farm WITH AND WITHOUT children aged 0–17 years. DO NOT offer “Children shouldn’t do that” as a response; just record it if respondent indicates that.]

Not everyone agrees on the age at which children are ready to help with farm work. We would like to get your opinion about some farm activities. How old do you think a child should be when they start doing each of the following activities?

- 23... drive a tractor? ## years old 98 Don't know 99 Children shouldn't do that  
 24... drive a pick-up truck? ## years old 98 Don't know 99 Children shouldn't do that  
 25... ride as an extra passenger on a tractor? ## years old 98 Don't know 99 Children shouldn't do that  
 26... drive a self-propelled combine? ## years old 98 Don't know 99 Children shouldn't do that  
 27... drive an all-terrain vehicle? ## years old 98 Don't know 99 Children shouldn't do that  
 27a... bale hay or straw? ## years old 98 Don't know 99 Children shouldn't do that  
 28... do chores around cows? ## years old 98 Don't know 99 Children shouldn't do that  
 29... do chores around hogs? ## years old 98 Don't know 99 Children shouldn't do that  
 29a... work in hog confinement building? ## years old 98 Don't know 99 Children shouldn't do that  
 29b... clean out grain bin? ## years old 98 Don't know 99 Children shouldn't do that  
 29c... work in silo? ## years old 98 Don't know 99 Children shouldn't do that  
 29d... power wash confinement buildings? ## years old 98 Don't know 99 Children shouldn't do that  
 30... apply fertilizers or pesticides on field crops? ## years old 98 Don't know 99 Children shouldn't do that  
 31... handle fertilizers or pesticides; for example, carry containers or mix solutions? ## years old 98 Don't know  
 99 Children shouldn't do that  
 32. In general, do you think the age children are allowed to start farm work should be different for boys and girls?  
 1 Yes 2 No GO TO NEXT SECTION 8 Don't know GO TO NEXT SECTION

33. In general, who do you think should be allowed to start farm work at a younger age, girls or boys?  
 1 Girls 2 Boys 3 Girls and boys at the same age 8 Don't know

## APPENDIX 2. YOUTH QUESTIONNAIRE PART 1 (Ages 12 through 17)

### AGRICULTURAL TASKS

Now I am going to ask about any farm work you have done.

- 16a. Have you EVER worked around farm equipment or in a farm setting for at least 10 hours per week for one year OR for 1 month out of a year, either for pay or not for pay?  
 1 Yes 8 Don't know GO TO QUESTION 28  
 2 No GO TO QUESTION 28 9 Refuses GO TO QUESTION 28
- 16b. Are you currently doing any farm work for 10 hours or more per week? This would include work on someone else's farm or chores on your parents' farm.  
 1 Yes 2 No

[FOR QUESTIONS 17–41, "BEHAVIOR" QUESTIONS (17–27) ARE ASKED FIRST ON ODD DAYS AND "ATTITUDE" QUESTIONS (28–41) ARE ASKED FIRST ON EVEN DAYS.]

{ORDER} # 1 = ODD DATE 2 = EVEN DATE

How old were you the first time you did each of the following farm activities? If you haven't done these things just tell me.

17. . . . drive a tractor? ## years old 98 Don't know 99 Have not done this yet GO TO QUESTION 18
- 17a. Have you done this in the past 12 months? 1 Yes 2 No
18. . . . drive a pick-up truck? ## years old 98 Don't know 99 Have not done this yet GO TO QUESTION 19
- 18a. Have you done this in the past 12 months? 1 Yes 2 No
19. . . . ride as an extra passenger on a tractor? ## years old 98 Don't know 99 Have not done this yet  
 GO TO QUESTION 20
- 19a. Have you done this in the past 12 months? 1 Yes 2 No
20. . . . drive a self-propelled combine? ## years old 98 Don't know 99 Have not done this yet GO TO QUESTION 21
- 20a. Have you done this in the past 12 months? 1 Yes 2 No
21. . . . drive an all-terrain vehicle? ## years old 98 Don't know 99 Have not done this yet GO TO QUESTION 21b
- 21a. Have you done this in the past 12 months? 1 Yes 2 No
- 21b. . . . bale hay or straw using equipment? ## years old 98 Don't know 99 Have not done this yet GO TO QUESTION 22
- 21c. Have you done this in the past 12 months? 1 Yes 2 No
22. . . . do chores around cows ## years old 98 Don't know 99 Have not done this yet GO TO QUESTION 23
- 22a. Have you done this in the past 12 months? 1 Yes 2 No
23. . . . do chores around hogs? ## years old 98 Don't know 99 Have not done this yet GO TO QUESTION 23b
- 23a. Have you done this in the past 12 months? 1 Yes 2 No
- 23b. . . . work in hog confinement building? ## years old 98 Don't know 99 Has not done this yet GO TO QUESTION 23d
- 23c. Have you done this in the past 12 months? 1 Yes 2 No
- 23d. . . . clean out grain bin? ## years old 98 Don't know 99 Has not done this yet GO TO QUESTION 23f
- 23e. Have you done this in the past 12 months? 1 Yes 2 No
- 23f. . . . work in silo? ## years old 98 Don't know 99 Has not done this yet GO TO QUESTION 23h
- 23g. Have you done this in the past 12 months? 1 Yes 2 No
- 23h. . . . power wash confinement buildings? ## years old 98 Don't know 99 Has not done this yet GO TO QUESTION 24
- 23i. Have you done this in the past 12 months? 1 Yes 2 No
24. . . . apply fertilizers or pesticides on field crops? ## years old 98 Don't know 99 Have not done this yet  
 GO TO QUESTION 25
- 24a. Have you done this in the past 12 months? 1 Yes 2 No

25. . . . handle fertilizers or pesticides, for example, carry containers or mix solutions? ## years old 98 Don't know 99  
Have not done this yet GO TO QUESTION 26
- 25a. Have you done this in the past 12 months? 1 Yes 2 No
26. Have you had any organized farm safety training?  
1 Yes 2 No GO TO Question 28 8 Don't know GO to Question 28
27. Did you receive any organized farm safety training from any of the following: [LIST 2. READ ALOUD.]  
1 Yes 2 No 8 Don't know

{YTH27a} # Veterinarian  
{YTH27b} # Extension service  
{YTH27c} # University medical school  
{YTH27d} # Vo-Ag program (community college)  
{YTH27e} # Insurance company  
{YTH27f} # Farm or commodity organization  
{YTH27g} # Local farm chemical or feed supplier  
{YTH27h} # Local farm equipment dealer  
{YTH27i} # 4-H or FFA program  
{YTH27j} # Farm safety day camp  
{YTH27k} # Other farmers  
{YTH27l} # Other organization Specify

[IN THE FOLLOWING QUESTIONS, DO NOT OFFER "CHILDREN SHOULDN'T DO THAT" as a RESPONSE. JUST RECORD IT IF RESPONDENT INDICATES THAT.]

Not everyone agrees on the age at which children are ready to help with farm work. We would like to get your opinion about some farm activities. How old do you think a child should be when they start doing each of the following activities?

28. . . . drive a tractor? ## years old 98 Don't know 99 Children shouldn't do that
29. . . . drive a pick-up truck? ## years old 98 Don't know 99 Children shouldn't do that
30. . . . ride as an extra passenger on a tractor? ## years old 98 Don't know 99 Children shouldn't do that
31. . . . drive a self-propelled combine? ## years old 98 Don't know 99 Children shouldn't do that
32. . . . drive an all-terrain vehicle? ## years old 98 Don't know 99 Children shouldn't do that
- 32a. . . . bale hay or straw using equipment? ## years old 98 Don't know 99 Children shouldn't do that
33. . . . do chores around cows? ## years old 98 Don't know 99 Children shouldn't do that
34. . . . do chores around hogs? ## years old 98 Don't know 99 Children shouldn't do that
- 34a. . . . work in hog confinement building? ## years old 98 Don't know 99 Children shouldn't do that
35. . . . clean out grain bin? ## years old 98 Don't know 99 Children shouldn't do that
36. . . . work in silo? ## years old 98 Don't know 99 Children shouldn't do that
37. . . . power wash confinement buildings? ## years old 98 Don't know 99 Children shouldn't do that
38. . . . apply fertilizers or pesticides on field crops? ## years old 98 Don't know 99 Children shouldn't do that
39. . . . handle fertilizers or pesticides; for example, carry containers or mix solutions? ## years old 98 Don't know 99 Children shouldn't do that
40. In general, do you think the age children are allowed to start farm work should be different for boys and girls  
1 Yes 2 No GO TO QUESTION 41a 8 Don't know GO TO QUESTION 41a
41. In general, who do you think should be allowed to start farm work at a younger age, girls or boys?  
1 Girls  
2 Boys  
3 Girls and boys should be allowed to start at the same age  
8 Don't know