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Causal Factors In Production Agriculture Injuries: Working Children And Youth Versus Adults

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Abstract. The high incidence rates of agriculture-related fatal and nonfatal injuries are a continuing concern. Some surveillance information is available about injury types and circumstances. However, a gap remains about whether injuries to working children and youth (i.e. aged 6-17) differ from those experienced by adults and whether they require a unique prevention strategy. We reviewed existing literature and selected high quality studies of traditional agriculture areas with both age and injury causal factor breakdowns. We reclassified injury causal factors into types according to a simplified scheme and included our own data from Wisconsin's fatal and nonfatal surveillance systems. We located very few published studies of traditional agriculture areas with good case ascertainment, large sample sizes, and breakdowns of injury causal factors by age ranges. When fatal and nonfatal injury data from Ontario, Canada and Wisconsin, USA were reclassified according to our simplified scheme for causal factors, there were few important differences between adults and working children and adolescents in rankings or proportionate weights. Other data suggested that children and youth in traditional agriculture areas perform, by and large, the same types of work as adults and are exposed to the same hazards. Better surveillance information is needed to guide prevention practices and intervention research, especially data about ages, causal factors, and other aspects of injury circumstances. This limited review suggests that the same injury reduction strategies can benefit adults and working children and adolescents.

1. Introduction

There are few age restrictions on work in production agriculture by minors in the US. Children and adolescents are routinely exposed to agricultural work hazards at an early age according to an Iowa telephone survey [1] and a reader poll conducted by a US farming periodical [2]. Children and adolescents aged 6-17 perform production agriculture work for a variety of reasons, often related to the economic importance of their labor contribution. Work in production agriculture is known to be extremely hazardous compared to most industries, especially for adolescent workers [3]. We wanted to determine whether the usual causes of agricultural injuries to children and adolescents in traditional agriculture regions were largely the same as those for adults.

2. Material and Methods

We reviewed injury data papers from traditional agricultural regions and selected those where: 1) sufficient injury numbers were available to provide some confidence in the estimates, 2) injury circumstances were depicted in sufficient detail and grouped so recoding according to our simplified scheme was possible, and 3) comparisons between

child and adolescent injuries and those of adults were obtainable. Since local and regional differences in the breakdown of crops and livestock produced and in farming practices and methods largely determined what hazards both adult and non-adult workers were exposed to (and consequently, the distribution and types of injuries encountered), only papers from traditional agricultural regions were considered. In Tables 1-3 below, the injuries reported in the original papers were grouped into large categories in an attempt to clarify the similarities and differences across age groups. The tables should be interpreted cautiously. In some cases, other investigators may differ with our decisions about particular groupings. Some tables include data from 0-5 year old children who were probably too young to be working and more likely to have been injured as "bystanders".

3. Results and Discussion

Data from Ontario and Wisconsin show that children and adolescents aged share much the same fatal injury mechanisms as adults in rank and proportionate weighting. Robert Brison and William Pickett are two Canadian epidemiologists who have published a half dozen papers in as many years on production agriculture injuries across the age span in the province of Ontario [4,7]. As in Wisconsin, most farms in Ontario are family owned and operated (90%), and most are involved in "traditional agriculture" in type and scale: dairy, beef cattle, pork, hay and forage crops, small grains, and poultry [7]. We believe Ontario's experience is relevant to Wisconsin, other US North central states, and to other regions where "traditional agriculture" predominates (e.g. US Northeast, much of the South, parts of the Northwest and Southwest).

When a comprehensive accounting was made of fatal agricultural injuries in Ontario (by reviewing death certificates and coroner reports), Brison and Pickett found that the injury mechanisms associated with the deaths were remarkably similar across the workforce age range [4]. Child and adolescent workers suffered fatal injuries from tractors, machinery, animals, and falls in approximately the same proportion as younger and older adults (see Table 1).

The University of Wisconsin-Madison maintains a registry of farm-related fatalities that captures data from a variety of sources including death certificates, coroner reports, and local newspaper clippings [5,6]. The rank and proportionate weight of fatal injury mechanisms for Wisconsin children (0-17 yrs) strongly resemble those for all ages (see Table 1). Tractors lead, with 44% of child and adolescent deaths and 35% of all ages. Machinery is a close second with animals third. The Wisconsin data overall also resemble the Ontario data. As in Ontario, the top killer in Wisconsin, with over 30% of the fatalities

Table 1. Fatal Agricultural Injury In Ontario And Wisconsin

	Ontario			Wisconsin	
	0-19 yrs n=91	20-44 yrs n=105	45-64 yrs n=99	0-17 yrs n=460	All ages n=121
Tractor	33%	33%	42%	44%	35%
Machinery	17%	20%	14%	25%	26%
Animal	2%	2%	5%	2%	10%
Fall	8%	4%	10%	4%	3%
Motor vehicle	2%	4%	7%		
Other	38%	37%	22%	27%	26%
Total	100	100	100	100	100

SOURCES: Ontario: death certificate and coroner report review covering 1984-92 in [4].
 Wisconsin: 0-17 yrs: UW farm fatality registry covering 1970-90 (includes 129 Indiana child fatalities) from [5]. All ages: UW farm fatality registry covering 1992-1994 in [6].

Table 2. Nonfatal Agricultural Injury In Ontario

	0-15 yrs n=16	16-44 yrs n=136	45-64 yrs n=59
Tractor & Machinery	19%	32%	25%
Animal	13%	10%	17%
Fall	13%	12%	24%
Lifting	13%	26%	19%
Other	43%	19%	15%
Total	100	100	100

SOURCE: Data from a 1991 population-based mail survey of 2000 farms in [7].

in the under 18 and in the all age group, is the tractor, with machinery-related fatalities a relatively close second, and animal-related fatalities a distant third.

Data from Ontario and Wisconsin show that children and adolescents also share the same nonfatal injury mechanisms as adults in rank and with similar proportionate weights. Nonfatal injury data are harder to collect than fatal since readily available public records such as death certificates and coroner reports are not produced. A nonfatal injury may produce no record unless asked about. Pickett and Brison used a mail questionnaire with a population-based sample representative of the entire province to ask about nonfatal injuries across three age ranges [7]. Although the numbers of child and adolescent injuries were small (n=16) compared to the size of the adult groups, the distribution of injury mechanisms for the child and adolescent group strongly resembled those of the two adult groups for tractors and machinery, animal, fall and lifting injuries (see Table 2).

As was the case in Ontario, accurate, representative Wisconsin numbers for nonfatal injuries were harder to come by than for fatal injuries. One available comparison is a case series or accounting of all relevant nonfatal injury cases treated in a hospital emergency room. These data come from a central Wisconsin regional trauma center where the most severe cases are more likely to present. Dean Stueland and his colleagues at the St. Joseph's Hospital in central Wisconsin tabulated nearly 800 nonfatal injuries associated with production agriculture work across three age ranges [8]. Unlike the Ontario nonfatal injury data, Stueland provided age breakdowns starting at 6 years, an age at which children may be performing work rather than being injured exclusively in "bystander" status. The proportionate attribution of injury mechanisms across the child and adolescent category (6-18 yrs) and the two adult age categories is so similar as to be interchangeable (see Table 3).

However, the data in reference [8] are a case series and may not be representative of the entire state of Wisconsin geographically or according to the state's distribution of types of operations within the agriculture industry (e.g. dairy, other livestock, small grains, etc.). Like Pickett and Brison's work in Ontario, only a population-based data gathering effort in Wisconsin can provide these answers.

In the early 1990s, the University of Minnesota did just that by conducting a phone survey of 800 Wisconsin agricultural operations selected to be representative of the entire state by size, location, and type of operation [9]. The total numbers of nonfatal injuries identified were too small to elucidate differences across age ranges. When the results for all ages in Wisconsin from the phone survey are combined, their distribution of nonfatal injury mechanisms resembles that found for children and adolescents (age 6-18) and for adults in the central Wisconsin hospital case series [8] (see Table 3).

Our argument is that, at least for the selected Wisconsin and Ontario data we present, there are strong indications that children and adolescents suffer from injuries of the same types and in nearly the same proportions as adults. As a result, this modest review of the limited available evidence suggests that the same interventions can benefit children, adolescents, and adults working in agriculture.

TABLE 3. Nonfatal Agricultural Injury In Wisconsin

	Hospital Case Series			Population-Based Survey
	6-18 yrs n=198	19-45 yrs n=452	46-65 yrs n=173	All ages n=167
Tractor	7%	5%	8%	7%
Machinery	17%	15%	16%	16%
Animal	21%	25%	24%	34%
Fall	15%	13%	18%	8%
Motor vehicle	5%	3%	2%	-
Tools	12%	14%	8%	-
Other	24%	25%	24%	36%
Total	100	100	100	100

SOURCES: Hospital case series: From a central Wisconsin regional trauma center case series covering 1986-88 in [8]. Population-Based survey: from a telephone survey of 800 WI farms covering 1989-92 in [9].

Better data on work, hazard exposures, and injuries among working children and adolescents versus adults are certainly important to confirm or disprove the highly tentative findings presented here.

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References

- [1] C. Hawk et al. Pediatric Exposure To Agricultural Machinery: Implications For Primary Prevention. *Journal of Agromedicine* 1 (1994) 57-73.
- [2] C. Tevis. Downsizing Farm Chores. *Successful Farming*. February (1994) 48-51.
- [3] L. Stallones and P. Gunderson. Epidemiological Perspectives On Childhood Agricultural Injuries Within The US. *Journal of Agromedicine* 1 (1994) 3-18.
- [4] R. Brison and W. Pickett. Fatal Farm Injuries In Ontario, 1984 Through 1992. *Canadian Journal of Public Health* 86 (1995) 246-248.
- [5] E. Sheldon and W. Field. Fatal Farm Work-Related Injuries Involving Children And Adolescents In Wisconsin And Indiana. In: H. McDuffie et al. (eds) *Agricultural Health and Safety*. Boca Raton: Lewis, 1995, pp 355-362.
- [6] M. Purschwitz and C. Skjolaas. Wisconsin Farm-Related Fatalities. Wisconsin Center for Agricultural Safety and Health. University of Wisconsin Biological Systems Engineering Department, Madison, WI. 1992-1994.
- [7] W. Pickett et al. Nonfatal Farm Injuries In Ontario: A Population-Based Survey. *Accident Analysis and Prevention* 276 (1995) 425-433.
- [8] D. Stueland et al. Agricultural Injuries To Children In Central Wisconsin. *Journal of Trauma* 31 (1991) 1503-1509.
- [9] S. Gerberich et al. Regional Rural Injury Study (RRIS): A Five State Population Based Effort Funded by the Centers for Disease Control, 1989-1992. University of Minnesota School of Public Health, St Paul MN. 1993.

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