
Fatal Farm Injuries to Children

by

Mark A. Purschwitz, Ph.D.



Wisconsin Rural Health Research Center

**Marshfield Medical Research Foundation
a Division of Marshfield Clinic**

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The Wisconsin Rural Health Research Center, which is affiliated with the Marshfield Medical Research Foundation (Division of the Marshfield Clinic), is actively engaged in policy relevant research that is directed toward identifying the health care needs of rural residents and the effects of administrative regulatory and legislative initiatives on the financing, management, and delivery of health care services in rural areas.

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The Center's newly established Health Policy Research Institute will focus on policy-relevant related to access to care for rural residents, health care financing, and private sector initiatives in providing health care services to rural residents.

Fatal Farm Injuries to Children is the first in a series of articles that strive to provide an overview of available knowledge on special topics in agricultural injury. In addition to the presentation of existing information, recommendations for prevention are made and the policy relevance of the material discussed.

Future articles in the series will cover non-fatal farm injuries to children, farm injuries to older workers, injuries involving tractors, injuries involving other farm equipment, injuries involving storage structures for grain, silage and manure, and a comparison of fatal and non-fatal farm injuries.

You may obtain courtesy copies of these articles as they become available by indicating your interest in receiving the Wisconsin Rural Health Research Center's agricultural injury series and providing us with your name and mailing address. Please direct written requests for information to:

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___ Farm Injuries Involving Storage Structures
___ Comparison of Fatal and Non-Fatal Farm Injuries

FATAL FARM INJURIES TO CHILDREN

Mark A. Purschwitz, PhD
Wisconsin Rural Health Research Center
Marshfield, Wisconsin

Too many farm parents and children learn the hard way that farming has many dangers for growing children. Between 175 and 300 children die in farm accidents each year, and thousands more are seriously injured. Many of these fatal accidents and injuries could and should be prevented. This article summarizes present knowledge on fatal farm injuries to children. A companion article will provide an overview of nonfatal farm injuries to children. Recommendations and policy implications for prevention will also be presented. It is hoped that this research can catalyze a national effort to prevent the needless deaths of hundreds of farm children each year.

Agriculture and Children

Discussion of farm injuries to children must begin with an understanding of the unique nature of agricultural work. The term "production agriculture" describes work done on farms, ranches and orchards. For those engaged in production agriculture, the worksite is typically also the place of residence. The farm and the home may not be discrete locations with distinct codes of conduct and safety. The children of farmers are routinely present where work is being done and may be inadvertently exposed to work-related hazards. These children may be present incidentally, such as by playing in the farm yard or buildings, observing work activities, or merely walking around. They may have been brought to the worksite by parents who wanted to supervise their children, rather than leaving them home alone. Or, the children may be engaged in productive work themselves.

Farm children are often encouraged by their parents to observe or participate in farm work. A sense of tradition and an appreciation for the importance of agricultural work may make involvement in farm activity appealing for the children themselves. Many farm parents speak

highly of the benefits of raising the family on the farm. It provides an opportunity to instill a strong work ethic in their children and to teach them the responsibilities of caring for living plants and animals. Children learn these values by contributing to the family effort and by observing others work.

In addition, it is often financially necessary (or at least more efficient) for children to help their parents on the farm. With seasonal peaks in work load, the farmer, rancher, or grower must increase his or her labor force. Because competent temporary farm labor is often scarce and/or children may be called upon to meet the additional labor requirements. Thus, children are very actively involved in many family farm operations, especially during harvest and other peak times.

Defining "Children" and "Farm Injury"

In this discussion of farm injuries to children, it is important to be aware that several definitions of "children" and "farm injury" are used in the literature.

"Children" are most commonly defined as individuals in the age range 0-14 years. Some reports, however, use an upper age limit of 15, 16, or even 18. Sometimes data are reported for age groups of 0-9 and 10-19, and the information for ages 10-14 cannot be isolated. In this article the age ranges are specified for each report cited.

Several definitions of "farm injury" are used in the literature. All refer to accidental injury; only accidental injuries are considered in this article.

One definition of "farm injury" includes all injuries reported with a location of "farm", excluding the farm home, regardless of the circumstances or activity surrounding the injury or the place of residence of the victim. Death certificate data are often based on this selection criteria.

A second definition differs from the first only by including rather than excluding the farm home and yard, in essence including anything occurring on property considered part of a farm.

A third definition expands on the second by including injuries occurring to farm residents while off the farm, regardless of where or how the injuries occurred. Highway motor vehicle injuries, off-farm recreational injuries, and other non-work-related, off-site injuries are included with those occurring on farms.

A fourth definition of "farm injury" includes only those injuries directly related to farm operations or those occurring on the farm worksite. This definition, which could also be called "agricultural injury", or "farm work/worksites injury" not only excludes injuries occurring in the home and yard around the home, but recreational injuries and others which occur on farm property but have nothing to do with farm work or the farm worksite. It includes injuries occurring off farm property which involve farm work, such as a tractor accident on a public road. The place of residence of the victim is immaterial to this definition of "farm injury".

Because this article is concerned primarily with hazards related to farm work or the farm worksite, the last definition is preferred. Because of variations in the literature, however, the definitions will be given as provided in the reports cited.

Numbers of Fatal Farm Injuries to Children

The number of children dying from farm injuries each year is not precisely known. Rivara (1985) reported an average of 286 fatalities per year, based on 1979-81 National Center for Health Statistics (NCHS) mortality tapes (death certificate data) selected for farm location of injury, but this included children and adolescents ages 0-19. For ages 0-14, the annual average was 174. These averages include any fatal unintentional injury occurring on a farm, excluding the home and yard. Farm work/worksites injuries are not reported separately. Drownings which may or may not be farm work/worksites related, were involved in about 30 percent of the deaths to children ages 0-14. Accidents involving firearms, which are typically not farm work/worksites related, were involved in about 10 percent. When firearm fatalities are excluded from the data, we find an annual average of 155-160 possibly farm work/worksites related fatalities of children.

Farm machinery was involved in about 40 percent of the farm fatalities to children ages 0-14, or approximately 60-65 fatalities per year. Using 1979-83 Consumer Product Safety Commission (CPSC) death certificate data selected for involvement of farm machinery, and not farm location, Rivara found about 69 deaths per year among children ages 0-14. McKnight (1984) found an annual average of 65 farm machinery deaths among children ages 0-14, using CPSC death certificate data for 1975-81. Baker and Waller (1989) used NCHS mortality tapes and found an average of 85 farm machinery deaths per year to children ages 0-14, irrespective of location, for the years 1980-85.

Field and Tormoehlen (1982) found an annual average of six farm fatalities among children ages 0-15 in Indiana (1970-81), based on death certificates. This figure represents 14.3 percent of all farm fatalities in Indiana. These fatalities included only work/worksites related deaths, including very few drownings. Tormoehlen (1986) found an annual average of 16 such fatalities in Wisconsin from 1970 to 1984, representing 28.6 percent of all farm work/worksites fatalities. Tormoehlen's data were based on newspaper reports. Schneider (1986) used multiple sources and reported that 20.6 percent of Nebraska farm work and worksites fatalities involved victims ages 0-15, averaging nine per year from 1969 to 1985. Minnesota (1984-88) averaged 7-8 such fatalities per year, based on data from multiple sources, or 18.2 percent of all farm fatalities (Schultz, 1985; True and Schultz, 1986; Anonymous, 1987; Anonymous, 1988; Anonymous, 1989). Murphy (1985) used multiple sources and found that Pennsylvania averaged 9-10 farm work and worksites fatalities to children ages 0-14 during 1980-84, or 19.0 percent of all such fatalities. Young (1978) reported that 19 percent of Ohio's fatal tractor accidents involved children ages 0-14, based on newspaper reports and follow-up investigations.

Because few states have published data about the number of farm fatalities in their states and the percentage of those which involve victims ages 0-14, it is not known whether the 14.3 to 28.6 percent range given above is representative of most states. The National Safety Council (1989) estimates there were 1500 work-related agricultural deaths in the United States in 1988, including children; a great majority of these appear to be related to production agriculture, i.e., farm work (Purschwitz, 1989). If 15 to 20 percent of these deaths were children ages 0-14, this would translate into 225-300 deaths annually. This is higher than Rivara's total of 155-160

possible farm work or work site fatalities. However, Stallones (1989) found in Kentucky that 23 percent of the farm-related deaths were not identified on death certificates as having occurred on farms. McKnight (1984) discussed the limitations of CPSC death certificate data. Thus, it is reasonable to assume that between 175 and 300 children die in farm work/worksites accidents each year, and the wide range suggests a need for additional research.

Rates of Fatal Farm Injuries to Children

For all fatalities with a reported location of "farm", Rivara (1985) calculated rates for children ages 0-14 of 9.7/100,000 to 13.7/100,000 farm population, depending on the specific age range of the children. Rates increased steadily with age and were three to six times higher for boys than for girls. Stallones (1989) found rates of non-motor vehicle farm fatalities in Kentucky of 10.6/100,000 to 19.0/100,000 for ages 0-14, with rates for boys being 1.5 to 6 times higher than for girls, depending on age. Fritsch and Zimmer (1980) found rates of 12.6 to 13.5/100,000 for ages 0-13, which were lower than rates for older age groups. It should be noted that Rivara, Stallones, and Fritsch all included deaths due to drownings and firearms, which can contribute 30 to 40 percent of farm fatalities for some ages. Salmi et al (1989) included deaths occurring on a farm or involving farm equipment or structures and reported a death rate of 3.2/100,000 rural children in Wisconsin and 1.5/100,000 in Illinois, with rates three times higher for boys than girls.

Baker and Waller (1989) reported that children ages 0-14 die in farm machinery accidents at a 5-year average national rate of 0.2/100,000 population (all children in the United States ages 0-14) with rates in some states as high as 0.9/100,000. This compares with a rate of 7.2/100,000 for motor vehicle accidents, the leading killer. Of course, children in the United States have considerably more exposure to motor vehicles than to farm machinery.

For tractor-related fatalities involving victims age 0-9, Karlson and Noren (1979) found an annual death rate of 4.1/100,000 for male farm children. So few deaths involved females that they were not included in the study. This compared with a rate of 13.6/100,000 for male farm residents of all ages. McKnight (1984) found average annual farm machinery death rates of

5.65/100,000 for farm residents ages 0-4, and 4.87/100,000 for ages 5-14. These rates were lower than all other age groups, which averaged 7.78/100,000. However, children had the highest or near-highest rates for specific types of fatal accidents. For tractor runovers (in which the tractor runs over the victim) the highest rates were for children ages 0-4 at 2.25/100,000. More tractor runovers occurred at age 3 than any other age. For fatal falls from tractors, ages 0-4 had a rate of 1.55/100,000, second only to the age group 65 and older, which had a rate of 1.6/100,000.

Doss and Pfister (1972) calculated rates based on hours of operation; children ages 5-14 had a fatality rate of 1.1 fatal tractor accidents per million hours of operation, which was second highest only after the age group 65 and older, which had a rate of 2.5 per million hours. Since children are unlikely to have the same exposure to farm hazards as adults, basing rates on hours of exposure rather than on population would seem to be a more appropriate method of calculating rates, although exposure data use difficult to obtain.

It is apparent that the many different ways to calculate rates makes them difficult to compare. However, it is important to note that rates for boys are much higher than for girls, which for older children is probably indicative of differences in levels of exposure. It is also important to recognize that while overall rates for children (based on population) are lower than for adults, there are certain types of accidents for which children have as high or higher rates than adults.

Age Distribution of Fatal Farm Injuries to Children

Tormoehlen (1986) reported peak fatal accident frequencies to children at ages 2 and 12-15. Field and Tormoehlen (1982) reported peaks at ages 2 and 5, 14 and 15. It is believed that these roughly bimodal distributions are indicative of the fact that very young children are at risk simply by being at the work site, either alone or in company of an adult, while the older children have greater actual work exposure as they take on more farm responsibilities. There seems to be no lower age limit for farm fatalities; the youngest victim reported in the literature was two months old (McKnight, 1984).

Calendar Distribution of Fatal Farm Injuries to Children

Peak months for fatal farm injuries to children appear to correspond with times of peak farm activity, particularly planting and harvest. Rivara (1985) found nationally that fatal injuries to children ages 0-14 most frequently occurred in May through October, with July as the peak month. In Wisconsin, Tormoehlen (1986) found peaks for ages 0-15 in June and July, which is haymaking time, with minor peaks in April, August, and October. Salmi et al (1989) found in Wisconsin that ages 1-4 had peak months in June, July, and October, while June was clearly the peak month for ages 5-9. Field and Tormoehlen (1982) reported peak months for ages 0-15 in Indiana were August, September, and October, with May, June, and July being other key months.

Types of Fatal Farm Injuries to Children

There are numerous ways in which children are fatally injured on farms. In addition to accidents involving tractors and machinery (see McKnight, 1984; Rivara, 1985; Tormoehlen, 1986), causes of death among farm children include grain bin entrapments (Field and Bailey, 1979); exposure to toxic manure gases (Donham, et al, 1982); accidental hanging in a haymow (Tormoehlen, 1986); being hit by falling trees (Tormoehlen, 1986); truck runovers (Jepson, 1981); pesticide poisoning (Salmi, et al, 1989); mauling by a bull (True and Schultz, 1986); fires (Pugh, 1985); falls (Davis et al, 1988); electrocutions (Field and Tormoehlen, 1982); drownings (Salmi et al, 1989); ATV accidents (McKnight and Hetzel, 1986); and firearms (Stallones, 1989). Wilk (1986) reports children of migrant workers are subject to the same potentially fatal hazards as their parents, including acute poisoning and work-related motor vehicle accidents.

Several studies have reported distributions of the various types of fatal farm work or work site accidents involving children. In Indiana, Field and Tormoehlen (1982) reported that 61.6 percent of fatal farm work/worksites accidents involved tractors and 20.5 percent involved other types of farm machinery. Suffocations accounted for 8.2 percent, and the remainder was divided among electrocutions, falls, and drownings. Tormoehlen (1986) reported 40.6 percent of the child farm work/worksites fatalities in Wisconsin involved tractors and 30.8 percent involved other

farm machinery. Suffocations accounted for 10.5 percent, with the remainder being divided among falls, livestock, electrocutions, fires and burns, woodcutting, drowning, and motor vehicle accidents. Rivara (1985), who included all fatal injuries in the U.S. with farm locations, reported tractors and machinery were involved in one-third the fatalities for all children, but nearly half of the fatalities for ages 0-9. As previously mentioned, he also reported that 30 percent died in drownings, 10 percent due to firearms, and about eight percent from suffocation. Farm animals only accounted for 1.8 percent of the deaths, and poisoning less than 1 percent. Stallones (1989) found that 30.2 percent of farm fatalities among Kentucky boys involved machinery, 34.9 percent involved drownings, 13.9 percent involved firearms, and 9.3 percent involved motor vehicles. Both Rivara and Stallones found that the percentage of machinery fatalities decreased and the percentage of firearm accidents increased with age.

The problem of extra riders on tractors is a significant one. Young (1978) found that 13 percent of 737 Ohio tractor fatalities involved extra riders; 73 percent of those extra rider victims were under the age of 10. He also found that in 42 percent of these fatal situations the driver was a father or brother; in 24 percent of the situations the driver was ages 11-15. Andreano and Nashold (1977) reported the most frequent cause of fatal farm accidents among Wisconsin children was falling off the tractor and being run over. McKnight (1984) found that in one-fourth of deaths involving falls from tractors, the victims were under the age of 9, including a two-month-old infant. One-fourth of the tractor runover accidents (which are often preceded by falling from the tractor) claimed victims under the age of 12, with peak ages being 1 to 4.

Clearly tractors and machinery are involved in large numbers of child farm fatalities. Virtually every type of farm machine has been involved in a fatal accident. However, because there are many other hazards which result in child deaths, all must be considered when prevention programs are developed.

Recommendations for Prevention

The number of children dying on farms in work or worksite related accidents speaks compellingly for the need for prevention. In no other industry are so many children lost each year.

Tractors and other farm machines are involved in a high percentage of fatal accidents and should be the primary focus of prevention activities. Children are especially vulnerable to falling from tractors and being run over; the common practice of taking along children perched on a fender or in the driver's lap is simply not safe. Young children also are frequently run over as pedestrians and must be kept away from tractor operations. However, since children can be killed in a variety of other farming situations, a comprehensive prevention program is necessary to protect children from the machines, structures, chemicals, animals, or toxic environments which may do them harm.

Prevention through Education

Educational efforts must inform both parents and children of the potential hazards that farm operations pose to children. Parents must understand the importance of giving their children age-appropriate tasks and the potential consequences of bringing or allowing children into the work place. Young children must be taught to recognize the dangers they may face, and older children must be trained in safe work practices.

The need to educate children has not gone unrecognized. Tractor programs in 4-H have included safety education, and vocational agriculture classes include several periods of safety education. Ten and 20-hour certification classes are required by law for children age 14 to 15 who wish to operate tractors and machinery for hire on farms other than their parents' (United States Department of Labor, undated). These classes are offered in various communities and counties. Children who work only on the family farm may also attend these classes.

While existing education programs are undoubtedly beneficial for those who attend, they all remain voluntary and the quality of the curriculum varies greatly from program to program.

There are no uniform standards for safety education curricula. It is not known how effective the education has been. Until an adequate evaluation or surveillance mechanism is developed, it will be difficult to measure the impact of safety education for farm children.

Farm safety education programs for adults are also available, but like the programs for children, they have yet to be thoroughly evaluated. It is especially unclear whether or not programs for adults have any effect on the safety of farm children. The work/worksites related risk to farm children is just one of many topics that may or may not be covered adequately by adult agricultural safety education programs. Extension safety specialists at land grant universities have provided farm safety education directly and through the media since the 1940s, although only about half of the states have a full-time safety specialist position. Even in states where a safety specialist is on staff, an entire state is difficult for one individual to adequately cover. Farm organizations, such as the Farm Bureau, also offer farm safety education. While education programs are available, they are not compulsory and it is difficult to say how many farmers take advantage of them.

Some recent efforts do hold out a great deal of promise. For example, a new organization called "Farm Safety for Just Kids" has drawn attention to safety problems and is specifically promoting farm safety education for both children and parents. Extension safety specialists are addressing the problem. The popular media has recently given the problem more attention. (Freiberg, 1989; Tevis and Finck, 1989).

What is needed is a systematic and organized approach to educating children and parents alike. For children, injury prevention should be a formal, distinct component of the agriculture curriculum to ensure that it receives adequate attention. The subject should be treated seriously and thoroughly by instructors. If it is merely alluded to, touched upon, or otherwise covered lightly, it will not seem important. Formal community classes that follow a professionally developed curriculum should be made available and vigorously promoted among all children who live or work on a farm. In Canada, farm safety curricula for schools have been developed in at least two provinces (Jones, 1987; Centre Hospitalier Universitaire de Sherbrooke, 1985). The American Academy of Pediatrics Committee on Accident and Poison Prevention (1988) has gone on record advocating the teaching of farm safety in curricula for primary grades through high school.

Adult safety programs and materials must formally address issues related to risks to farm children. Many adults attend community education sessions voluntarily but have a notoriously poor record of attending "safety meetings". It may be beneficial to rely upon grassroots parental networks to improve attendance at safety sessions. Adults often express more concern for the safety and welfare of their children than they do for their own safety. These sentiments may be used to generate interest in programs designed specifically for farm parents. A sense of local "ownership" of these programs may also stimulate greater turnout.

Other Avenues for Prevention

Education is not the only means by which farm injuries to children can be prevented, though it may be the most viable one. Other approaches to prevention are discussed below.

The role of the engineering community in child farm safety is uncertain. It is somewhat paradoxical that as newer machines are ergonomically improved to minimize operator fatigue and stress and fit a wider range of body sizes, they become increasingly operable by children. Certainly the elimination or minimization of existing discomforts or hazards related to farm equipment is crucial to injury prevention in general, but designing farm machines especially for operation by children is inappropriate. These machines, which cut, chop, grind, transport, or otherwise process agricultural products, require mature operation and always will. However, engineering solutions should not be ruled out, and potential risks to children must be considered in the design of new equipment and structures.

Because of the risk of extra riders on tractors, it has been suggested by some that tractors be designed to accommodate extra riders, including infants. The safety implications of such a design, such as providing protection during a rollover, or potential distraction of the operator, are beyond the scope of this article.

For children, however, the more general problem is their mere presence in the workplace, whether that presence involves riding on a tractor or just walking around the farmstead. The solution may be in developing child care options for farm parents like those available to many parents who work in factories or offices. Other solutions may be as simple as providing secure,

fenced-in play areas for children that are attractive and fun and keep them out of the barnyard. These solutions should be explored and evaluated by professionals working with farm parents.

In a free and democratic society, legally imposed regulation should be a last resort, and certainly any restriction of the activities of farm children is an exceedingly sensitive area. Federal law requires certification of 14 and 15-year-olds employed for tractor and machine operation and prohibits employing them for certain tasks, but this does not apply to children on their own farms. It is believed that this law is seldom if ever enforced. If motor vehicle accidents involving tractors driven by children were known to be a significant problem, it is conceivable that licensing might be required for road operation of tractors. This could be justified by the presence of the tractor in a public place. However, as much as it may make sense from an injury prevention standpoint to restrict child exposure to farm hazards, issues of parental responsibility and freedom are involved, and it seems unlikely that regulations restricting children on their home property should or even could be promulgated or effectively enforced.

Policy Implications

Historically, farm safety efforts have been greatly underfunded when compared with similar efforts in other industries (Purschwitz and Field, 1988). There is little doubt that farm injury prevention efforts for children have suffered due to lack of personnel and funds. Correcting the problem will require time and money.

As mentioned before, many states lack a full-time Extension safety specialist at their land-grant university. This is particularly true outside the midwest, which accounts for the relative lack of information on child farm fatalities in these areas. The U.S. Department of Agriculture should be encouraged to increase its annual Extension safety allocation of approximately \$19,000 per state to a level that will support a full-time specialist in each state.

Formal educational programs in schools and in other settings should be developed, implemented, and evaluated as part of an expansion of existing farm safety education efforts. Young children should learn as early as kindergarten about farm hazards, which will be of value even if they do

not live on a farm but have occasion to visit. Older children need to understand the responsibilities and hazards they accept if they operate equipment.

Parents should learn about child development as it relates to farm operations and age-appropriate tasks. They need help in the decision-making process with regard to appropriate farm activities for their children. Parents can benefit from a better understanding of the behavioral limitations of children of various ages, and how best to provide training.

All of these programs must be designed with multidisciplinary (including farm family) input and must not be designed in isolation in federal or state government offices. Cooperation and involvement of a variety of groups must be considered (Purschwitz et al, In Press).

Child care options for farm families must be explored and developed where necessary. The exhortation to a young mother to not take a child along on the tractor or into a hazardous work area, when there seems to be no alternative, is unrealistic and extremely stressful when there is work to be done and time is of the essence.

Incentive programs to make farms safer places to work should be explored with insurance companies, state governments, and even machinery manufacturers. Society clearly reacts to stimuli that affect the pocketbook.

Legislators should discuss the subject of relevant regulations with farm groups, not from an advocacy position, but to get farm family feedback. This action will create debate within the farming community and serve to focus media and community attention on the subject. The importance of public concern and attention cannot be overvalued; educational and other efforts will have the greatest impact when the citizenry is concerned about the problem.

Scientific surveillance of farm injuries to children needs support from local, state and national levels. Studies should explore, among other things, the actual hours of exposure of children to various hazards. Active surveillance through health care providers and others must be developed on a wider scale than past isolated short-term studies. Without on-going surveillance, intervention programs cannot truly be evaluated.

Finally, the psychological and social needs of those parents whose children have been seriously injured or killed in farm accidents should be addressed by appropriate providers. There is anecdotal evidence to indicate that these needs often go unmet and result in tremendous personal and family suffering. Perhaps those who have lost a child themselves could become strong allies in efforts to prevent recurrence of such tragedies.

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