

---

## Factors Influencing Exposure of Children to Major Hazards on Family Farms

---

Barbara C. Lee, RN, PhD, Louise S. Jenkins, RN, PhD, and James D. Westaby, PhD

**ABSTRACT:** *On family farms, parents are usually knowledgeable of high-risk activities, yet they allow their children to be active participants in (or bystanders to) hazardous work for reasons not well-documented. A two-phase descriptive study, based on the theory of planned behavior and using mail survey research methods, was carried out to understand factors that influence parents' decisions to expose children to major hazards on family farms. A representative sample of 1,255 Wisconsin dairy farm fathers provided data about factors that influence their decisions to expose children younger than 14 years to risks of injury. Multivariate analyses revealed that attitudes, subjective norms, and perceived control accounted for up to three-fourths of the variance in fathers' behavioral intentions. Fathers' attitudes were stronger predictors of behavioral intentions than subjective norms (i.e., perceived social pressure) or perceived control. Grandparents and mothers exerted a limited influence. Other groups, such as health care providers, 4-H, Future Farmers of America, and insurers, exerted only a modest influence on fathers' feelings of social pressure. Few demographic characteristics of the family or farm were predictive of fathers' intentions to expose children to hazards.*

The idyllic image of family farm life in the United States began to crumble when the *Des Moines Register* published its Pulitzer Prize-winning "Harvest of Harm" series describing traumatic injuries to adults (Knudson, 1984). This was followed by accounts in *Successful Farming* (Tevis & Finck, 1989), *USA Today* (Keen & Walmer, 1989), and *The Boston Globe* (Butterfield, 1990), which detailed devastating injuries experienced by children who were working with their parents on farms. The family farm has acquired growing public recognition as a dangerous environment for youngsters who are unaware of the risks associated with an occupational work site. Indeed, for more than a decade, farming has maintained its ranking as one of

the most hazardous occupations in the United States, along with construction and mining (Baker, O'Neill, Ginsburg, & Li, 1992; National Safety Council, 1995; Stout, Jenkins, & Pizatella, 1996).

Parents with family farms often struggle with the dilemma of dual responsibilities of performing animal chores or field work while simultaneously caring for children. Children observe and frequently participate in a full range of agricultural production activities in the barn, field, or farmyard. Adding to this predicament, the farm environment is quite intriguing to children, who may approach their surroundings as a giant playground.

Data from national, state, and regional reports suggest that childhood agricultural injuries are frequent,

severe, and often preventable. The essence of successful injury prevention is knowing how, when, and where to target actions that might remove or reduce risk of injury by using strategies based on knowledge of why the injury occurs. There is little empirical evidence of the pre-existing conditions or explanations for children's presence near agricultural hazards. The purpose of this study was to enhance the understanding of factors influencing parents' decisions to expose children to major hazards on family farms.

## Background

In 1991, there were 923,000 children younger than 15 years of age and another 346,000 children 15 to 19 years of age residing on U.S. farms and ranches (Dacquel & Dahmann, 1993). Geographically, more than one-half of all farm residents live in the Midwest states, where family farms predominate (U.S. Department of Commerce, 1994). Another 800,000 children live in households of hired farmworkers and may work on farms with their parents (U.S. Department of Agriculture, 1987). Given that one-third to one-half of childhood agricultural injuries occur to nonresidents (Miller, 1995; Stueland, et al., 1995), it is estimated that more than 2 million children are at risk of agricultural trauma each year.

In the absence of comprehensive annual reports of fatal and nonfatal agricultural injuries in the United States, the scope of the problem is drawn from studies using various sources, methods, definitions, and classification schemes. Across those states that collect fatality data, between 14 percent and 29 percent of farm fatality victims are children younger than 16 years of age (Purschwitz, 1990). Fatality rates are reported to be highest among young men ages 15 to 19, at 30.9 deaths/100,000 rural residents (Rivara, 1985). A review of nonfatal childhood agricultural injury studies conducted by Stallones and Gunderson (1994) revealed wide variability in injury rates across studies. These ranged from 2.3 to 30.9/100,000 rural residents among different age and gender cohorts. A recent study of nonfatal childhood agricultural injuries in central Wisconsin reported an injury rate among 14- to 17-year-old men of 27.2 injuries per 1,000 farm residents of the same age and gender (Stueland, Lee, Nordstrom, Layde, & Wittman, 1996). For both fatal and nonfatal injuries, there is minimal gender variation prior to age 5 (Purschwitz, 1990; Stallones &

Gunderson, 1994). After age 5, nearly all injury events are more predominant among men (Stallones & Gunderson, 1994).

Fatal and nonfatal injuries to children on farms are most often associated with farm vehicles and machinery, livestock, buildings, and falls (Purschwitz, 1990; Rivara, 1985; Stallones & Gunderson, 1994; Stueland, Layde, & Lee, 1991). Tractors are implicated most frequently in childhood agricultural fatalities. A study of 460 Wisconsin and Indiana childhood agricultural fatalities throughout a 10-year period revealed that 50 percent were associated with tractors (Sheldon & Field, 1995). Among all working 16- and 17-year-olds in the United States during the years 1980 through 1989, 44 percent of machine-related deaths were associated with tractors (Castillo, Landen, & Layne, 1994). Animals, machinery, tools, falls, and structures account for both fatal and nonfatal injuries. In the Midwest, nonfatal childhood agricultural injuries are most frequently associated with livestock, typically with injuries occurring during feeding, grooming, and standing in the vicinity of dairy cows (Cogbill, Busch, & Stiers, 1985; Gerberich, et al., 1993; Stueland, et al., 1991).

Education, engineering, and public policy efforts to reduce or eliminate adult and childhood agricultural injuries have had limited success, as evidenced by a modest decline in injury statistics (National Safety Council, 1995). As with other public health concerns, such as the use of tobacco products, education, and training in farm safety have had a limited effect on safety behaviors (Hawk, Donham, & Gay, 1994; Murphy, 1981). Engineers have not found it feasible to "design out" the hazards related to children's presence on the work site. The myriad of dangers within the different production agriculture environments has made it virtually impossible to ensure safe surroundings for

---

*This study was conducted with support from the National Institute for Nursing Research (NIH 1F31NR06759) and the National Institute for Occupational Safety and Health (NIOSH U07/CCU507126). Results reported are a component of the dissertation research of the first author, available from UMI Dissertation Services No. 9532475. The authors extend gratitude to the project consultant, Robert Aherin, PhD, of the University of Illinois and to Cindy Nikolai and Alice Stargardt of the National Farm Medicine Center for assistance throughout the project.*

*From the National Farm Medicine Center, Marshfield Medical Research and Education Foundation, A Division of Marshfield Clinic, Marshfield, WI 54449; School of Nursing, University of Maryland, Baltimore, MD 21201; and New York University, New York, NY 10003. For further information, contact: Barbara C. Lee, RN, PhD, National Farm Medicine Center, 1000 North Oak Avenue, Marshfield, WI 54449.*

children, and off-site child care may be unavailable or unaffordable.

Public policy has been given minimal consideration as a viable intervention for reducing injuries on farms. Standards of the Occupational Safety and Health Act (OSHA) are not applicable to farms employing 10 or fewer individuals, and about only 5 percent of U.S. farms employ 11 or more individuals (U.S. Department of Commerce, 1994).

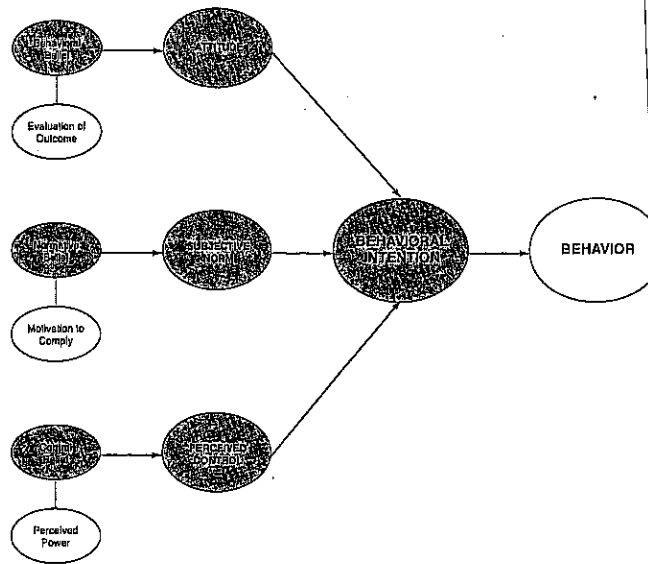
### Theoretical Framework

The guiding framework for this study was the theory of planned behavior (Ajzen, 1985), which is an extension of the theory of reasoned action (Ajzen & Fishbein, 1980). This theory has been used extensively to understand and predict health behaviors. Recently, it was used for childhood agricultural injury research (DeBarr, Ritzel, Wright, & Kittleson, 1994) and a study regarding protective behaviors of parents (Gärling & Gärling, 1993). The theory of planned behavior predicts behavior by considering intention, attitudes, perceived social pressures (subjective norms), and perceived control. The model shows how a small number of factors can be used to affect an individual's behavior in applied settings. The model also depicts the relative importance of different factors that influence behaviors. Key concepts in the model are illustrated in Figure 1.

### Purpose

This investigation used both quantitative and qualitative methods to explore behavioral intentions and factors influencing those intentions in the next six months of Wisconsin dairy farmers to allow their children younger than 14 years to: (a) drive a tractor with more than 20 horsepower; (b) be a second rider on a tractor without a cab that is driven by the father; and (c) be within 5 feet of the hind legs of a dairy cow. Research instruments measured attitudes, subjective norms, and perceived behavioral control factors for these three high-risk activities. Demographic data were collected to allow for exploration of whether any personal or farm characteristics were associated with exposure of children to hazards.

Figure 1. Theory of Planned Behavior.



Note: Shaded areas represent theoretical relationships described in this article.

Source: Theory of Planned Behavior as adapted from Ajzen, I., 1991. *Organizational Behavior and Human Decision Processes*, 50, p. 182.

### Methods

Qualitative methods were used to identify salient beliefs of farm fathers regarding a child's role in high-risk farming activities. Qualitative data guided development of a quantitative instrument used for this mail survey research. Study participants were drawn from a stratified random sample of 6,000 Wisconsin dairy farms as provided by the U.S. Department of Agriculture (USDA). One in every five farm households yielded an eligible participant—a dairy farm father with one or more children younger than 14 years of age living on the farm. Eighty-nine percent of these fathers agreed to participate in the study.

Specific directions on instrument development and theoretical issues are provided by Ajzen and Fishbein (1980) and Ajzen (1991). The survey instrument included: an illustrated title page with acknowledgments and approvals; an introductory page describing the purpose of the study, including the theoretical framework

and instruction page; 116 items on seven-point Likert-type and Semantic differential scales; six items regarding intentions of exposing a child to the three high-risk activities; up to 40 items related to age, gender, and previous exposures of each child to tractors and cows; four life satisfaction items; and 23 demographic items regarding the participant, his spouse, and his farm. Items measuring key constructs were based on the theoretical formula.

For example, a single behavioral belief was assessed with an item "allowing my child to drive a tractor saves money," measured on a seven-point scale of "very likely" to "very unlikely." The composite attitude score was the average of three items: "allowing my child to drive a tractor is ..." as measured on a seven-point scale of "very good" to "very bad," "very beneficial" to "very harmful," and "very wise" to "very foolish."

Before administration, the instrument was reviewed by agricultural safety specialists and behavioral scientists who had previous experience with this theoretical model. An estimate of the internal consistency of the constructs for all three behaviors was obtained using an alpha coefficient (Nunnally, 1978). Reliability estimates for the behavioral intention, attitude, and subjective norm sections of all three behaviors ranged from  $\alpha=0.90$  to  $\alpha=0.95$ . For the perceived behavioral control sections, reliability estimates were very low, ranging from  $(\alpha)=0.07$  to  $(\alpha)=0.19$ .

**Data Collection.** Data collection for this investigation incorporated protocols for time that would match the seasonal work patterns of Wisconsin dairy farmers, as well as mail survey research methods (Dillman, 1978). Qualitative data were collected from 104 farmers during December 1993 with a response rate of 87 percent. Quantitative data for the full study were collected during March and April 1994, using a \$10 gratuity as an incentive and two reminder mailings to nonrespondents. Usable data were collected from 1,151 eligible participants, yielding a response rate of 87.5 percent. Most data entry activities were conducted by staff of the Wisconsin Agricultural Statistics Service, primarily because of confidentiality required by the USDA. A data disk was submitted to the investigators, subjected to additional quality assurance, and then used in analyses.

## Results

### Characteristics of Farmers, Spouses, and Farms.

The average age of farm fathers with at least one child younger than 14 years old was 41 years ( $SD=6.8$ ). All but 4.5 percent had completed high school, and 42.4 percent had training beyond high school. Nearly all (95.8%) were full-time farmers. More than 80 hours of work/week were reported by 35 percent, and there were 15.6 percent who reported being employed away from the farm.

Spouses of the farm fathers tended to be slightly younger, with an average age of 39 years ( $SD=6.3$ ). Nearly one-half (49.1%) of these farm mothers reported being employed off-farm. There were an average of 5.1 individuals living in the farm household.

Farmers primarily relied on their immediate families to assist with work. It was reported that an average of 3.2 family members assisted the father with farm work. Thirty-five percent of farmers reported hiring one or more nonfamily workers. The majority (76.3%) of farmers were the sole owner/operator of their farms, including joint ownership with spouses. Fewer than one-third had started up their own farm, and nearly 12 percent reported they were at least the fourth generation living on that farm.

Farm sizes averaged 291 tillable acres with four tractors to perform farm work. Only one of four tractors was equipped with rollover protection (ROPS). Milking herd size averaged 59 cows ( $SD=45.3$ ), and all but 5 percent used a stanchion (or tie stall) milking arrangement that involved walking a center aisle and approaching cows from the back side.

**Children's Exposure to Hazards.** There were a total of 3,448 children (not limited to younger than 14 years) reported by the 1,151 study participants. When asked to indicate their intentions regarding their children who were younger than 14 years on a scale of very likely (+1) to very unlikely (+7), 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 (Table 1). None of these hazardous activities would be "unlikely" to occur.

**Attitudes, Subjective Norms, and Perceived Control.** Data were analyzed to determine the extent to which attitudes, subjective norms, and perceived con-

**Table 1. Farm Fathers' Intentions Regarding Three Behaviors.**

Behavior	Mean Score*	Standard Deviation	N†
Allow child** to drive tractor	2.16	2.31	872
Allow child*** to drive tractor	1.81	2.12	705
Allow child as extra rider	3.38	3.62	1,114
Allow child near dairy cow	2.29	4.71	1,109

- \* Mean score derived from seven-point Likert-type scale of very likely (+1) to very unlikely (+7). Therefore, the lower the score, the more likely the behavior. A 3.5 score would be neutral.
- \*\* Measured where the oldest child younger than 14 years was 7 years or older.
- \*\*\* Measured where the oldest child younger than 14 years was 10 years or older.
- † Number of fathers providing data.

control accounted for the variance in behavioral intention. Composite attitude, subjective norm, or perceived control scores (i.e., an average score of three individual items) were obtained for each of the three behaviors. Regression analyses revealed that these constructs in the theory of planned behavior accounted for two-thirds to three-fourths of the variance of intentions for all three behaviors (Table 2). Attitudes were at least twice as predictive of behavioral intentions as subjective norms and up to six times as predictive as perceived control.

To determine specific factors underlying attitudes, the Pearson *r* correlation was examined between each behavioral belief item and the composite attitude score for each behavior. Thirteen behavioral beliefs were assessed across all three behaviors, with only four of these common to all. Table 3 presents specific findings. The desire for a child to gain work experience had the strongest positive association with fathers allowing children to drive a tractor, being an extra rider on a tractor, and being near dairy cows. Many other positive associations for all three behaviors were significant. For the most part, the factors were related to positive effects on the child. A few factors, such as saving work time for the father, related to positive effects for the father or the farm.

Several behavioral beliefs also had negative associations with attitudes. Fear of injury to the child had a consistent, strong negative association for all three

**Table 2. Multiple Regression of Attitudes, Subjective Norms, and Perceived Control With Behavioral Intentions.\***

Construct	Behavioral Intention		
	Allow Child to Drive Tractor	Allow Child as Extra Rider	Allow Child Near Cows
	(Beta)	(Beta)	(Beta)
Attitudes	0.60	0.50	0.58
Subjective Norms	0.26	0.24	0.24
Perceived Control	0.09	0.11	0.16
R <sup>2</sup> adj**	0.79	0.67	0.74

- \* Behavioral intentions derived from mean score of three items measuring intention for each behavior.
- \*\* Adjusted R<sup>2</sup> with 3 *df* and significant at *F*=0.0000.

behaviors (-0.55, -0.53, -0.52). A negative association related to driving a tractor was the concern of possible damage to the vehicle. For the extra-rider behavior, fathers were concerned a child would distract the tractor operator.

Subjective norms were noted to account for about one-fourth of the variance in fathers' intentions to expose children to agricultural hazards (Table 2). To assess different sources of influence on farm fathers' subjective norms, correlations were computed between specific normative beliefs and the respective composite subjective norm score. Table 4 depicts results. For the extra-rider behavior and being-near-cows behavior, fathers' subjective norms were most strongly influenced by the children's grandparents. Mothers exerted the strongest influence on fathers' subjective norms to allow a child to drive a tractor. Groups like Future Farmers of America (FFA), 4-H, insurance companies, and health care providers exerted less influence on fathers' subjective norms. As noted previously, the construct of perceived control (as measured by three items that rated the subject's perspective of control over whether or not a child would drive a tractor, be an extra rider on tractor, or be near cows) contributed

**Table 3. Association of Behavioral Beliefs With Attitudes Toward Behavior.**

Belief	Correlation* With Attitude** Toward Behaviors		
	Allow Child to Drive Tractor	Allow Child as Extra Rider	Allow Child Near Cows
Child gains work experience	0.741***	0.505***	0.742***
Child develops strong work ethic	0.712***	—	0.689***
Child builds self-confidence	0.706***	—	—
Spend family time together	0.655***	0.477***	—
Saves work time for the father	0.653***	0.402***	0.624***
Saves money for the farm	0.615***	—	—
Fear of injury to child	-0.548***	-0.534***	-0.516***
Possible damage to tractor	-0.505***	—	—
Need to supervise	—	0.439***	—
Is fun for the child	—	0.250***	—
Distracts fathers' driving	—	-0.526***	—
Child gains respect for animals	—	—	0.692***
Cows become less jumpy	—	—	0.408***

\* Pearson *r* correlation coefficients.  
 \*\* Attitude derived from mean score of three items measuring attitude.  
 \*\*\* Two-tailed significance,  $P=0.001$ .

only minimally to the variance in farm fathers' behavioral intentions (Table 2) and had a low reliability coefficient. Therefore, generalizations about this construct would be tenuous.

**Relationship of Farm Characteristics and Exposure to Hazards.** As a supplemental analysis, the association between behavioral intention and 23 demographic characteristics were examined. Of these, only six statistically significant relationships were found, and these were not robust. The only characteristic with a statistically significant correlation across all three behavioral intentions was the number of family members working on the farm. The more members working on the family farm, the more likely it was for the child to be exposed to hazardous behaviors (Table 5).

**Participants' Life Satisfaction.** Although not included as a theoretical component of this study, four items related to personal satisfaction were measured to

**Table 4. Association of Normative Beliefs With Subjective Norms.**

Belief	Correlation* With Subjective Norms** Related to Behaviors		
	Allow Child to Drive Tractor	Allow Child as Extra Rider	Allow Child Near Cows
Child's grandparents think I should	0.767***	0.806***	0.892***
Wife thinks I should	0.800***	0.686***	0.837***
Groups like FFA, 4-H think I should	0.496***	0.366	0.478***
Insurance companies	0.471***	—	—
Health care providers	0.445***	—	—
Groups like OSHA, child advocates	0.234***	0.151***	—

\* Pearson *r* correlation coefficients.  
 \*\* Subjective norm derived from mean score of three items measuring subjective norm.  
 \*\*\* Two-tailed significance,  $P=0.001$ .

gain insight into the overall attitude participants held toward themselves, their role as a father, and their occupation as a farmer. The four questions were assessed on scales of strongly agree (+1) to strongly disagree (+7) and analyzed by simple descriptive analysis. Results are provided in Table 6. Participants demonstrated positive attitudes for all life satisfaction indicators, with the least satisfaction noted with family life on the dairy farm.

## Discussion

The theory of planned behavior was found to be a useful framework for understanding key factors affecting the presence of children in three high-risk situations on dairy farms. Farm fathers' attitudes were strongly associated with their intentions to allow children to drive a tractor, be an extra rider on a tractor, and be near the hind legs of dairy cows. For all three behaviors, the primary influence on a farm father's behavioral intentions to allow a child to engage in a high-risk behavior was his attitude toward that behavior, accounting for two-thirds to three-fourths of the variance in his intention. Thus, interventions targeted

**Table 5. Association\* of Selected Factors With Exposure of Children to Hazards.**

Characteristic	Correlation		
	Allow Child to Drive Tractor	Allow Child as Extra Rider	Allow Child Near Cows
Number of family members working on farm	0.275***	0.094**	0.288***
Age of farmer's wife	0.036	0.088**	-0.149***
Number of family members living on farm	0.022	-0.023	0.119***
Wife's work hour/week on farm	-0.069	0.048	0.155***
Total agricultural sales	0.019	-0.071	0.113***
Father's work hour/week on farm	0.008	0.047	0.104**
Number of tractors on farm	0.078	0.018	0.039
Total number of milking cows	-0.017	-0.028	0.021

\* Pearson *r* correlation coefficients.

\*\* Two-tailed significance, *P*=0.01.

\*\*\* Two-tailed significance, *P*=0.001.

at changing farm fathers' attitudes about their roles as protectors of children from farm hazards may be influential in altering the parameters they establish for children's presence and participation at the farm work site.

Study participants were representative of Wisconsin dairy farm fathers. The vast majority were full-time farmers, and about one-half of their wives were employed elsewhere. The near-constant presence of these fathers on the farm work site is not necessarily consistent with farm fathers' roles in other geographic regions or on farms of other types of agricultural enterprise. Therefore, results may not reflect the factors that influence fathers' decisions regarding children in other agricultural settings.

The primary influence on farm fathers' attitudes for two of the three behaviors was a desire for children to gain work experience in farming. There is ample evidence in the lay farm press that supports the influence family farmers exert over their children's roles on the farm, along with the tendency to gradually pass farm ownership and operating styles to the younger generation. Desire for children to develop a strong work ethic and build self-confidence also are important beliefs of farm fathers. Attributes of

**Table 6. Participants' Satisfaction With Life, Role as Father, and Farming.**

Factor	Mean Score*	Standard Deviation
Think I am excellent father	2.25	1.06
Satisfied with work on farm	2.55	1.47
Satisfied with my life	2.73	1.51
Satisfied with family life on farm	2.81	1.62

\* Mean score derived from seven-point Likert-type scale of strongly agree (+1) to strongly disagree (+7). A 3.5 score would be neutral.

hard work and personal integrity are highly valued.

While it is likely that driving a tractor influences physical and psychological development of children in a positive manner, the reality that a child may be placed into an adult, hazardous work situation cannot be ignored. On family farms, children of any age may legally drive a tractor. In contrast, child labor requirements in nonagricultural occupations under the Fair Labor Standards Act provide a minimum age of 18 years for work requiring operation of a motor vehicle. Minors between 16 and 18 years of age are exempted from this law under specific conditions (U.S. Department of Labor, 1990).

Fathers' attitudes about allowing children to drive tractors also were associated with their beliefs about saving time and money. While it is important for farm owners to achieve economic stability, the use of child labor for high-risk activities in other occupations is considered by some to be unethical and illegal (Beyer, 1994). Focus groups with farm parents revealed that until economic conditions improve for dairy farmers, children will continue to provide meaningful farm labor on the farm (Lee, 1992).

Farm fathers' attitudes regarding allowing a child to be a second rider on a tractor without a cab had a negative association with fear of injury and work distraction for the father, and were positively associated with desire for family bonding time and the need to supervise the child. Extended hours on the tractor are required during planting and harvesting seasons, precluding safer options for parent-child time. The benefits of this father-child bonding or supervising time must be weighed against potential injury to the child from a

tractor rollover, runover, or from exposure to noise, exhaust fumes, and vibration emitted by the tractor.

For most study participants, the stanchion barn structure would not allow a person to be in the barn alley and still be farther than 5 feet from the hind legs of a cow. Study results indicated that fathers' attitudes about allowing children in this hazardous setting are strongly influenced by their desire to help children gain respect for animals. A child who respects and understands animal behavior is likely to participate in animal husbandry activities of youth organizations, such as 4-H and FFA, and to be safer and more productive during milking chores. Handling of dairy cows may result in minor injuries, compared with the serious or fatal injuries associated with driving or riding on tractors. Work with dairy cows and other barn chores could be adapted for a relatively safe involvement of older children by making modest alterations in the work environment. These adaptations should be combined with routine use of personal protective equipment, such as steel-toed shoes, heavy gloves, and eye protection.

The people exerting the strongest pressure on fathers' subjective norm to allow or forbid children to be an extra rider on a tractor or be near the hind legs of dairy cows were grandparents. This finding may be explained by multigenerational farms and the presence of grandparents as active workers, supervisors, or guardians. This strong influence of grandparents on the exposure of children to agricultural hazards has not previously been reported in the literature or in farm safety initiatives. In a related matter, a recent study by Whitman and Field (1995) examined senior farmers (60 years and older) and found that perceptions of tractor and machinery-related risks were rated moderately in relation to other farm hazards. Additionally, only 26 percent of senior farmers believed that the protective benefits provided by ROPS on tractors outweighed the costs and inconvenience of installing them (Whitman & Field, 1995). The child's mother exerted the strongest influence on whether or not the child should be driving a tractor.

Results regarding social pressures exerted by grandparents and mothers should not be overlooked when considering strategies to influence protective behaviors of adults who bear responsibility for protecting children from agricultural injuries. Other groups, including rural health care providers, exert much less influence on fathers' feelings of social pressure than immediate family members. Yet, health care providers can use this knowledge to influence attitudes of grand-

parents and mothers regarding safe and appropriate roles for children on farms.

Results demonstrated a statistically significant relationship between the number of family members working on a farm and the father's intentions to allow a child to engage in high-risk behaviors; that is, the more family members working on the farm, the more likely that children younger than 14 years were exposed to hazards. It is not possible to explain this finding with certainty. Future research should address this issue.

Exposure of children to major hazards on farms is only partially explained by these study results. Decisions and concerns regarding children on farms include the full host of social issues, including substance abuse, teen pregnancy, and motor vehicle crashes, in addition to occupational injuries. This study made no attempt to compare behavioral intentions to protect children from other types of physical or psychological harm. Such information would be valuable in putting study results into perspective among the myriad of issues facing farm parents today.

## Conclusions

Significant strides have been made in reducing unintentional injuries to children associated with motor vehicles, fire, drowning, bicycles, and playground equipment (Wilson, Baker, Teret, Shock, & Garbarino, 1991). While these injury control measures have benefitted nearly all children, regardless of culture, socioeconomic status, or place of residence, there has been limited success in reducing childhood traumatic injuries associated with exposure to agricultural hazards. This investigation of factors influencing exposure of children to hazards on family farms provided empirical evidence of issues that may need to be accounted for by rural health care providers and others involved in childhood agricultural injury prevention strategies.

Study results emphasize the high value farm parents place on children's involvement in farm work. Farm parents have noble reasons for involving their children in farm tasks at an early age and justify risk of injury based on the potential benefit to the child and farm. Additionally, results depict the strong influence of grandparents and spouses on children's participation in high-risk activities. Therefore, to be successful, interventions should be sensitive to these factors.



Individual counseling, educational resources, youth group activities, and community-based initiatives are some of the strategies that may influence attitudes and perceived social pressures of farm fathers so they might eventually influence adoption of safe, appropriate behaviors regarding children's roles on farms.

Several issues could be considered in developing specific interventions. First, there could be a determination of which farm chores are developmentally and age-appropriate with minimal risk of serious injury for children. Guidelines for appropriate children's agricultural work tasks could be generated through a consensus-building process using the expertise of specialists in child development, pediatric sports medicine, industrial hygiene, and agricultural safety, along with active farm parents. Second, it may be necessary to explore innovative models for providing rural child care services so parents have reasonable options for keeping young children away from the work setting. Third, professional training could be offered to rural health practitioners to enable them to recognize and counsel high-risk families. Fourth, advocacy for selected public policy measures, such as revision of child labor laws applicable in agriculture, may need to be considered.

A comprehensive approach to childhood agricultural injury prevention is needed. Study results depict the many factors associated with exposure of children to major farm hazards. A starting point is to understand that social pressures exerted by grandparents and mothers, traditional practices, and economic forces should not be underestimated. Interventions could be designed with sensitivity to these factors, then implemented and carefully evaluated to assess how well they protect children from high-risk activities on farms. Lessons learned from those interventions deemed effective through systematic evaluation may then be widely disseminated by rural health care providers and child safety advocates.

## References

- Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckman (Eds.), *Action-control: From cognition to behavior* (pp. 11-39). Heidelberg: Springer.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, 50, 179-211.
- Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall Inc.
- Baker, S.P., O'Neill, B., Ginsburg, M.J., & Li, G. (1992). *The injury fact book* (2nd ed.). New York, NY: Oxford University Press.
- Beyer, D. (1994). Child labor in the '90s: Trouble spots and timely solutions. In *Child labor in the '90s: How far have we come?* (pp. 26-30). New York, NY: National Child Labor Committee.
- Butterfield, B.D. (1990, April 22-26). Children at work: A five-part series on child labor in the United States. *The Boston Globe*, p. 1. Boston, MA: Globe Newspaper Co.
- Castillo, D.N., Landen, D.D., & Layne, L.A. (1994). Occupational injury deaths of 16- and 17-year-olds in the United States. *American Journal of Public Health*, 84(4), 646-649.
- Cogbill, T.H., Busch, H.M., & Stiers, G.R. (1985). Farm accidents in children. *Pediatrics*, 76(4), 562-566.
- Dacquel, L.T. & Dahmann, D.C. (1993). *Residents of farms and rural areas: 1991. Current Population Reports, P20-472*. Bureau of Census, Washington, DC: U.S. Government Printing Office.
- DeBarr, K.A., Ritzel, D.O., Wright, W.R., & Kittleson, M.J. (1994). *Friends and family: Implications for youth tractor safety*. Columbia, MO: National Institute for Farm Safety. (NIFS Paper No. 94-7).
- Dillman, D.A. (1978). *Mail and telephone surveys: The total design method*. New York, NY: John Wiley & Sons.
- Gärling, A., & Gärling, T. (1993). Mothers' supervision and perception of young children's risk of unintentional injury in the home. *Journal of Pediatric Psychology*, 18(1), 105-114.
- Gerberich, S., Gibson, R., French, R., Carr, P., Renier, C., Gunderson, P., Martin, F., Irue, J., Shutske, J., & Brademeyer, K. (1993). *The regional rural injury study (RRIS-D): A population-based effort*. University of Minnesota, Minneapolis, MN: Department of Occupational and Environmental Health.
- Hawk, C., Donham, K.J., & Gay, J. (1994). Pediatric exposure to agricultural machinery: Implications for primary prevention. *Journal of Agromedicine*, 1(1), 57-74.
- Keen, J., & Walmer, T. (1989, October 30). "Danger" on USA's farms. *USA Today*, pp. 1, 3, 8.
- Knudson, T. (1984, September 16-23). A harvest of harm: The farm health crisis. *Des Moines Register*, p. 1.
- Lee, B.C. (1992, November, December). (Focus group interviews with 10 central Wisconsin farm mothers and six central Wisconsin farm fathers.) Unpublished transcription of taped interviews.
- Miller, T. (1995). *1987-1992 National Health Interview Survey*. Unpublished survey, Children's Safety Network Economics and Insurance Resource Center, National Public Services Research Institute, Landover, MD.
- Murphy, D.J. (1981). Farm safety attitudes and accident involvement. *Accident Analysis & Prevention*, 13(4), 331-337.
- National Safety Council (1995). *Accident facts: 1995 edition*. Chicago, IL: National Safety Council.
- Nunnally, J.C. (1978). *Psychometric theory*. New York, NY: McGraw Hill.
- Purschwitz, M.A. (1990). *Fatal farm injuries to children*. Marshfield, WI: Office of Rural Health Policy, Wisconsin Rural Health Research Center, Marshfield Clinic.
- Rivara, F. (1985). Fatal and nonfatal farm injuries to children and adolescents in the United States. *Pediatrics*, 76(4), 567-573.
- Sheldon, B.J., & Field, W.E. (1995). Fatal farm work-related injuries involving children and adolescents in Wisconsin and Indiana. In H.H. McDuffie, J.A. Dosman, K.M. Semchuk, S.A. Olenchok, & A. Senthilselvan (Eds.), *Supplement to agricultural health and safety: Workplace, environment, sustainability* (pp. 355-362). Boca Raton, FL: Lewis Publishers.
- Stallones, L., & Gunderson, P. (1994). Epidemiological perspectives on childhood agricultural injuries within the United States. *Journal of Agromedicine*, 1(4), 3-18.
- Stout, N.A., Jenkins, E.L., & Pizatella, T.J. (1996). Occupational injury mortality rates in the United States: Changes from 1980 to 1989. *American Journal of Public Health*, 86(1), 73-77.

- Stueland, D.T., Layde, P.M., & Lee, B.C. (1991). Agricultural injuries in children in central Wisconsin. *Journal of Trauma*, 31(11), 1503-1509.
- Stueland, D.T., Lee, B.C., Nordstrom, D.L., Layde, P.M., & Wittman, L.M. (1996). A population-based case-control study of agricultural injuries in children. *Injury Prevention*, 2, 192-196.
- Stueland, D.T., Mickel, S.H., Cleveland, D.A., Rothfusz, R.R., Zoch, T., & Stamas, P. (1995). The relationship of farm residency status to demographic and service characteristics of agricultural injury victims in central Wisconsin. *The Journal of Rural Health*, 11(2), 98-105.
- Tevis, C., & Finck, C. (1989). We kill too many farm kids. *Successful Farming*, 87(3), 18A-18P.
- United States Department of Agriculture. (1987). *The agricultural workforce survey of 1987*. Washington, DC: U.S. Government Printing Office, Economic Research Service, 1987.
- United States Department of Commerce. (1994). *Census of Agriculture*. (Report No. AC92-A-51). Washington, DC: US Government Printing Office.
- United States Department of Labor. (1990). *Child Labor Requirements in Nonagricultural Occupations Under the Fair Labor Standards Act*. (Report No. WH-1330). Washington, DC: US Government Printing Office.
- Whitman, S.D., & Field, W.E. (1995). Assessing senior farmers' perceptions of tractor and machinery-related hazards. *Journal of Agricultural Safety and Health*, 1(3), 199-214.
- Wilson, M.H., Baker, S.P., Teret, S.P., Shock, S., & Garbarino, J. (1991). *Saving children: A guide to injury prevention*. New York, NY: Oxford University Press.

ely  
(pp.  
part  
e, p. 1.  
nal  
s.  
nts in  
rural  
i of  
ice.  
94).  
umbia,  
. 94-7).  
gn  
ercep-  
he  
derson,  
13). *The*  
rt.  
t of  
to agri-  
n. *Journal*  
s farms.  
: farm  
ews with  
onsin  
views.  
mics and  
search  
lvement.  
hicago,  
:Graw  
field,  
lth  
1 and  
73.  
njuries  
ndiana.  
lenchock,  
lth and  
2). Boca  
ectives  
ates.  
nal injury  
0 to 1989.