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Supervision of Children in Agricultural Settings: Implications for Injury Risk and Prevention

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ABSTRACT. Farm environments pose unique safety hazards for children. With this in mind, this paper raises several points about how caregiver supervision influences risk of childhood injuries. First, research suggests that it is not the absence of a supervisor per se *but* the poorer quality of supervision that leads to pediatric injuries on farms, particularly for young children who behave in unpredictable ways at a time when caregivers are likely to be distracted with farm work. Second, research suggests that "adequate" supervision varies with context. In nonfarm contexts, continuous attention and close proximity (i.e., being within arm's reach) constitute an adequate level of supervision to ensure young children's safety. In agricultural contexts, attention and continuity are also relevant. However, close proximity is less beneficial because this often results in exposing children to hazards (animals, dangerous equipment) if the supervisor is working. Third, research suggests that in both agricultural and nonagricultural contexts, the extent to which supervision is associated with injury varies with a child's developmental level. Specifically, supervision seems to play a more primary role in moderating injury risk for young children (preschool), and this influence decreases as children age and increasingly independent are allowed to engage in more activities without a supervisor present. Building on these findings, practical recommendations are provided to enhance the safety of children on farms and future research directions are discussed.

KEYWORDS. Children, prevention, safety guidelines, supervision, unintentional injury

INTRODUCTION

Purpose of This Paper

The farm is a unique environmental context for children because it is not only where they live and play, but also a workplace that contains many hazards from which children need to be protected. One strategy that caregivers often implement to protect children is supervision. This paper provides an overview of research on relations between caregiver supervision and childhood injury. Although the primary aim is to advance our understanding of injury risk for children in agricultural settings, because of the dearth of research on supervision in this unique context, findings from research in nonagricultural settings are also considered. In addition to reviewing empirical research, the paper considers outstanding issues regarding how to define supervision and determine what constitutes "adequate" supervision,

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provides recommendations on ways to reduce pediatric agricultural injuries, and identifies a number of questions that are important to consider in future research. It should be acknowledged that there is a lack of evidence about supervision within immigrant, migrant, and seasonal farmworker populations; therefore, foundational research is needed before it can be determined whether the conclusions and recommendations expressed herein also apply to these agricultural workers. It should also be noted that there are some behavioral interventions that have demonstrated success in improving caregiver supervision in the home and at school,[1–3] but whether these approaches would apply in a farm context remains to be determined.

Background

Unintentional injuries have replaced infectious diseases as the most serious child health issue in the industrialized world.[4] Pediatric agricultural injuries, in particular, have been recognized as a significant public health issue worldwide.[5–8] Injury statistics demonstrate unequivocally that children in agricultural settings are at risk for experiencing premature mortality,[5] morbidity,[9] and disability.[10] In the United States, for example, nearly half of all work-related fatalities to children occur in agricultural settings[11,12] and over 15,000 youth annually experience injuries of sufficient severity that mobility is restricted or medical attention is required.[13,14]

Much has been written about the leading mechanisms of injury for children on farms.[13,15–19] Common approaches to prevention have considered the popular "three Es" methodology: education, engineering, and enforcement.[20] For example, the North American Guidelines for Children's Agricultural Tasks (NAGCAT) aim to educate families about appropriate agricultural tasks for children at different ages. Human factors engineering emphasizes the sizing of farm equipment for adults (e.g., tractors) and how inappropriate sizing elevates injury risk when youth operate the equipment.[21–23] Recognition of limits associated with the "three Es" approaches to prevention, however, have paved the way for greater emphasis on person-centered injury prevention strategies, including caregiver supervision and hazard management. In fact, research on nonfarm families has shown that caregivers often use these strategies simultaneously, which can be highly effective in moderating children's injury risk.[24,25]

For farm families, few studies have considered caregiver supervision and how this influences children's risk of injury. This is surprising given that estimates indicate that a majority of childhood injuries are preventable,[26] and one common recommendation for prevention of injuries to children in the agricultural worksite is that caregivers provide "better supervision."[18,27] Indeed, one might hypothesize that supervision is a particularly important determinant of injury risk for children on farms because children's potential exposure to injury hazards is quite high (i.e., animals, equipment, ponds, and irrigation systems) due to it being both a home and worksite. The NAGCAT attempts to address supervision by suggesting what the minimal supervisory practices should be for each separate farm activity for children at different ages (e.g., for the same task: a 7–9-year-old should be watched constantly, a 10–11-year-old should be watched nearly constantly, and a 14–15-year-old should be checked on periodically). However, the efficacy of these guidelines has not been evaluated (i.e., would the suggested level of supervision prevent injury?), and some of the terms used are not clearly defined (e.g., nearly constantly, every few minutes, periodically), making it open to interpretation by caregivers.

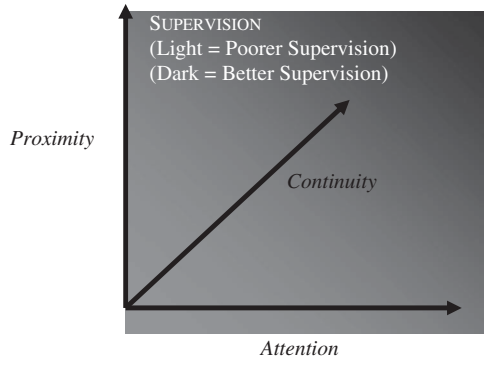
HOW TO DEFINE "SUPERVISION"?

Despite how often supervision is cited as being important for preventing childhood injuries,[28–32] few researchers actually define the term. Moreover, disagreement about how to define supervision is common among lay persons.[33] Even professionals who work extensively with children (e.g., medical personnel and social service workers) differ in how they conceptualize supervision.[34] Dictionary definitions

are equally confusing, with some citing specific behaviors (e.g., *seeing*) and others alluding to more general knowledge of a child (e.g., *monitoring*), which are quite different in terms of readiness to intervene and prevent injury. For example, watching a child allows one to estimate their exposure to injury risk with a high degree of accuracy, whereas monitoring or generally knowing where a child is does not provide sufficient information to know with certainty exactly what a child is doing.

Based on a consideration of readiness to intervene to prevent injury, Gitanjali and colleagues[35] proposed that three dimensions are important for defining supervision: *attention* (i.e., watching and listening), *proximity* (i.e., within versus beyond reach), and *continuity* in attention and proximity over time (see Figure 1). Building on this three-dimensional conceptualization, Morrongiello[36] defined "supervision" as referring to behaviors that index attention (watching, listening) in interaction with those that reflect readiness to physically intervene (proximity), with both types of behaviors judged over time to index continuity. Thus, according to this conceptualization, the more attentive and proximal to children caregivers are, and the longer this arrangement is sustained over time, the better the supervision that is provided. Interestingly, this conceptualization of *adequate* supervision is consistent with evidence from research with nonfarm families; however, the empirical evidence suggests this may not apply as well to agricultural contexts (see below).

FIGURE 1. Three dimensions of supervision (attention, proximity, continuity).



HOW DOES SUPERVISION RELATE TO CHILD INJURY?

Although injury researchers have generally been comfortable to *assume* that childhood injuries are due to inadequate supervision (see Roberts[37] for a commentary about the lack of empirical evidence), only recently have investigators identified ways to measure supervision using valid and reliable instruments.[36,38,39] These methodological innovations have paved the way for systematic research to scientifically examine relations between patterns of supervision and frequency of childhood injury. Because most injuries to young children (<6 years) occur in the home when they are presumably being supervised,[40,41] the majority of supervision research has focused on parents of young children under 6 years of age. Interestingly, a few recent studies have sought to extend this to parents of elementary school children; however, finding links between patterns of supervision and injury risk has proven more challenging, because as children age they are allowed greater independence, and therefore, the nature and scope of supervision changes and typically decreases.[42,43]

A review of the general pediatric injury literature reveals that some patterns of supervision (intermittent attention and decreased proximity) pose greater risk of injury than others (greater attention and proximity), and these results have been obtained with respect to both minor or home-treated injuries[24,25,44,45] and medically treated injuries.[46] Moreover, caregiver supervision has been shown to interact with other factors to moderate injury risk. Thus, the level of supervision needed to ensure a child's safety varies depending on the level of environmental risk and child behavioral characteristics. Near open water like a lake or beach, for example, where drowning risk is quite high for young children, more active supervision is needed, although evidence indicates caregivers routinely inadequately supervise.[47–49] Similarly, in more economically deprived neighborhoods where there are more physical hazards, constant attention and closer proximity is needed to promote children's safety.[50] For children who are very active and behave intensely,

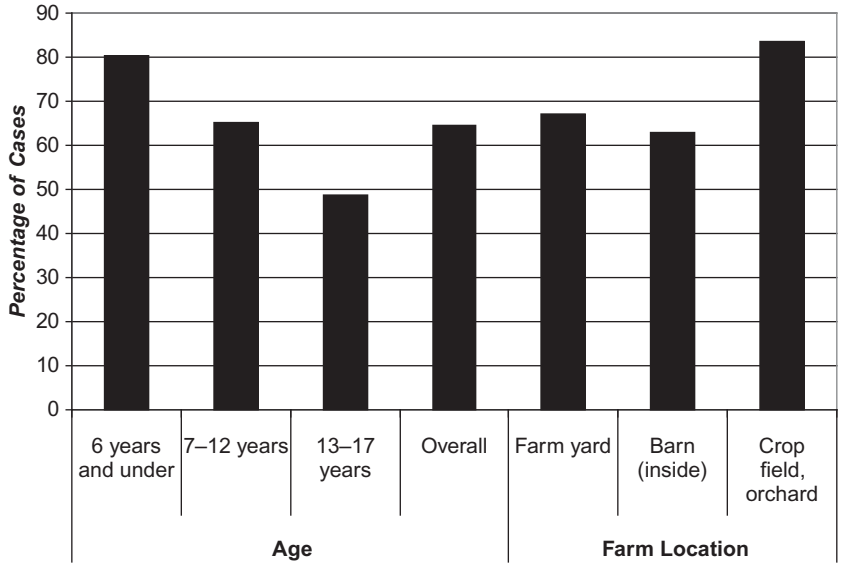
closer supervision is associated with reduced frequency of injury, whereas poorer supervision (inattention, not within arm's reach of child) predicts more frequent injury.[51] Thus, in identifying links between supervision and child injury risk there is increasing recognition of the importance of taking a broader perspective that considers how supervision *interacts* with child and environmental factors to moderate injury risk for children.[44,45]

Although research examining interactions among risk factors in pediatric agricultural research is limited, recent advances highlight the importance of doing so.[36,52] For example, Morrongiello and colleagues[53] studied how children's behavioral attributes interact with level of environmental risk among young and older children. Their results indicated that injuries were more frequent when a young child behaved unexpectedly in a high-hazard context (i.e., near animals or equipment) than a low-hazard context. In contrast, at older ages, children's behavioral attributes played less of a role than environmental context and unexpected events. Hence, examining interactions of risk factors has revealed an important finding: although the same factors can contribute to injury risk for children across a broad age range, the relative weighting of how these factors influence injury risk often changes with children's developmental status.

Extending this approach, the authors sought to determine if supervision interacts with child and environmental factors to influence injury risk.[53] They identified a case series of 334 pediatric farm injuries that had resulted in death or hospitalization. Utilizing narrative reports about the circumstances leading to injury, they considered three developmental stages (<6 years of age; 6–12 years; 13+ years), level of environmental risk (low: no physical hazards mentioned; high: at least one hazard of animal or equipment mentioned), and level of supervision at the time of injury (attention = adult was available to supervise or not; proximity = within arm's reach or not; continuity was assumed unless the record indicated otherwise).

Results revealed that injury rate was affected by the amount and type of supervision provided, and these relations varied depending on the child's developmental level. As shown in Figure 2, nearly 80% of injuries to young children under 6 years of age occurred when an adult supervisor was available (i.e., attention was coded "yes"). With increasing age, more injuries occurred when a supervisor was not

FIGURE 2. The percentage of injuries to children aged 6 to 18 years when a supervisor is present and paying attention to the child's activities.



present; however, even for the oldest group nearly 50% of injuries occurred when a supervisor was present. Hence, availability of a supervisor is clearly not sufficient to keep children safe in agricultural settings, particularly young children who often behave unpredictably at this developmental stage.[53]

With respect to proximity, as shown in Figure 3, having a child near a supervisor was not a protective (i.e., risk-reducing) factor, particularly if the child was young. For children under 6 years, nearly 60% of injuries occurred when the child was within reach of the adult. This high rate of injury probably reflects the fact that the potential supervisor was farming at the time, resulting in him/her not fully attending to the child continuously and the child being near hazards (animals, equipment) with which the parent was involved; support for this interpretation comes from the finding that for nearly half of the injuries that occurred in the crop field, about 50% of these involved the child being an extra passenger on a tractor (data not shown). Hence, whether proximity has a risk-reducing (nonfarm context) or risk-enhancing (farm context) effect depends on where this occurs and the extent to which physical hazards are present in this location. If parents are farming at the time, the risks of the child being exposed to animal or equipment hazards are elevated.

Figure 4 shows the percentage of injuries that occurred when the supervisor was presumed to be continuously attending to the child. Across child age, about 40% of injuries occurred under these supervision conditions. As found for the proximity data, about 50% of injuries in the crop field involved the child as an extra rider on a tractor.

Finally, Figure 5 shows the percentage of injuries that occurred under what would typically be considered "adequate" supervision conditions (supervisor available, child proximal to supervisor, continuous). About one third of injuries occurred under such conditions, and this estimate reached over 50% in crop fields. These findings highlight the challenge of defining "adequate" supervision in a way that applies across all contexts.

Examining other aspects of the data provide additional insights into how supervision links to injury risk for children in agricultural contexts. First, when an injury occurred with an adult supervisor available, 84% of the time the potential supervisor was engaged in farm work. Clearly, dividing attention between farm work and supervision is associated with

FIGURE 3. The percentage of injuries to children aged 6 to 18 years when a supervisor is present and within arm's reach of the child.

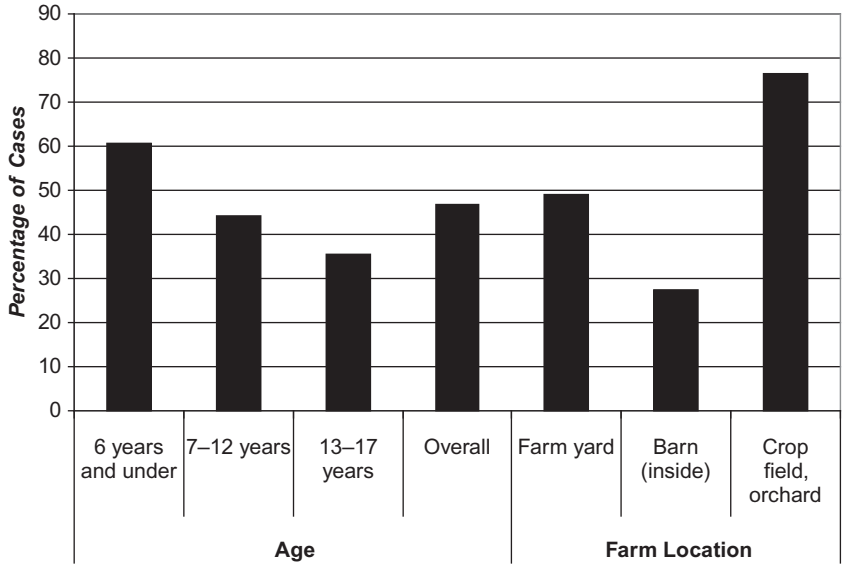


FIGURE 4. The percentage of injuries to children aged 6 to 18 years when supervision was assumed to be continuous.

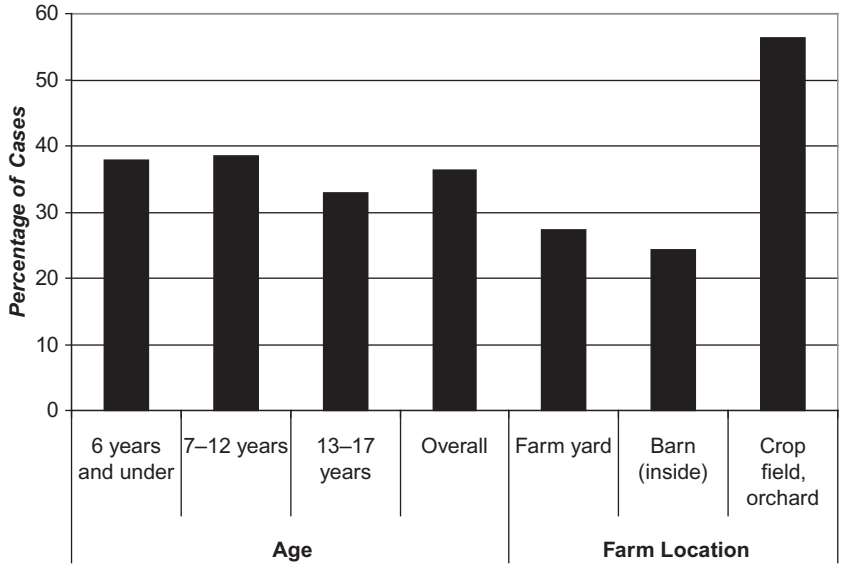
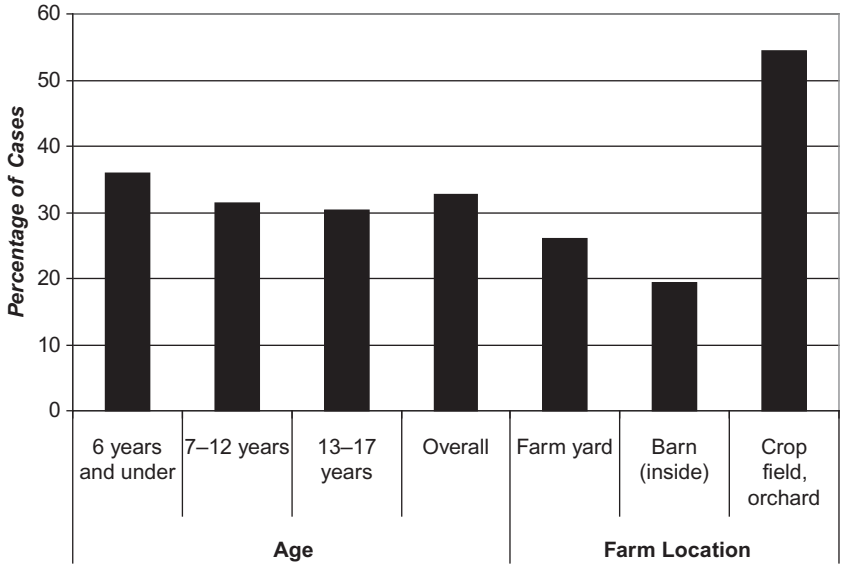


FIGURE 5. The percentage of injuries to children aged 6 to 18 years when supervision was deemed adequate (i.e., there was attention, proximity and continuity).



high rates of injury to children. Similarly, increasing demands on a supervisor occur when more than one child is present. The fact that 25% of injuries occurred under these conditions suggests that such conditions may merit additional supervisors, particularly given the high incidence of hazards that typify agricultural contexts with which young children might interact. Finally, over 16% of injuries to children occurred when more than one potential

supervisor was present. Clearly delineating who is responsible for supervision is essential when more than one potential supervisor is present, otherwise the presence of additional supervisors does not necessarily serve a protective role for children.

WHAT ARE SOME MEANINGFUL CONCLUSIONS BASED ON THE EVIDENCE TO DATE?

First, it is often not the absence of a supervisor per se *but* the poorer quality of supervision that leads to pediatric injuries on farms, particularly for young children who often behave in unpredictable ways at a time when caregivers are likely to be distracted with farm work. Interestingly, past research indicates that parents often have high self-efficacy beliefs that they can keep their young child safe,[54] and this confidence can be associated with reduced (inadequate) supervision.[55] To improve supervision practices, therefore, it may be necessary to challenge these self-efficacy beliefs, perhaps by emphasizing that the unpredictability of young children's behavior, which is typical at these young ages, reduces a caregiver's ability to ensure children's safety *unless* they are actively supervising.

Second, although the evidence suggests that the dimensions of attention, proximity, and continuity are valid, how one draws on these dimensions to define "adequate" supervision may need to vary with context. In nonfarm contexts, such as the home or playground, there is unequivocal evidence that continuous attention and being within arm's reach constitutes an adequate level of supervision to ensure young children's safety most of the time. In agricultural contexts, attention and continuity also seem to be relevant dimensions, with greater attention and continuity moderating children's risk of injury. However, close proximity (keeping child near supervisor) does not apply as well because this often results in exposing children to environmental hazards (animals, dangerous equipment) if the parent supervisor is working, which is often the case. In agricultural contexts, therefore, proximity may be either a protective or *risk* factor, depending on *what* the supervisor is doing and the age of the child.

Finally, in both agricultural and nonagricultural settings, the extent to which supervision is associated with injury varies with a child's developmental level, although similar supervision-injury associations occur across contexts. Specifically, the evidence to date suggests that supervision plays a more primary role in moderating injury risk for young children (preschool), and this influence decreases as children age and become increasingly independent and allowed to engage in more activities without a supervisor present. The importance of proper training (e.g., on using equipment and safety practices) and selecting developmentally appropriate tasks for older youth to do in agricultural contexts becomes increasingly important as direct supervision declines. The NAGCAT can aid in guiding this process.

RECOMMENDATIONS AND IMPLICATIONS FOR FUTURE RESEARCH

The foregoing literature review supports a number of recommendations, and these differ depending on the child's developmental level. For purposes of organizing these recommendations based on developmental level, they are differentiated into two groupings: those for *younger* children apply to children under 6 years of age, and those for *older* children apply to those 6 years and older. This age divide reflects transitioning to school and accompanying growing independence which is reflected in changes in the primary location of injuries (e.g., proximal to home for younger children versus elsewhere for older children[41]) and is consistent with divisions used in past research on supervision, including in farm contexts.[51,53] In terms of the Blueprint template, most recommendations represent a blending of Research, Intervention, and Knowledge Mobilization suggestions. Incorporated in each recommendation are strategies to be implemented to promote parents' understanding and acceptance that the

issue is relevant to their child and to counteract likely inappropriate "shortcuts" parents might consider taking that would undermine their effectively addressing the issue.

It should be noted that many of these recommendations fall within the "voluntary compliance" domain, and parents are not likely to be punished for failing to comply. Some have argued that inadequate supervision that leads to injury should be reported as neglect or child abuse,[56] and there are some instances in which parents have been charged in the accidental deaths of their children. In Edmonton, Alberta, Canada, for example, parents who were repeatedly warned that their children needed closer supervision when playing outside were charged with criminal negligence causing death when their 5-year-old son was killed cycling while unsupervised.[57] Similarly, in an Amish community in Pennsylvania in 2006, a father was charged with endangering the welfare of a child and reckless endangerment following the death of his 8-year-old son in an incident involving a tractor-powered feed grinder on their farm.[58] Whether punishing parents with the aim of raising awareness among farm families of these safety issues actually serves to promote improvements in supervision remains to be determined. Interestingly, public opinion often dismisses this practice, because many people feel this "blames the victim" and is not appropriate.

Younger Children (Under 6 Years of Age)

For young children the most important consideration is to *keep them from interacting with hazards*, with "hazards" broadly defined to include animals, equipment, physical features of the environment, and chores and recreational activities that pose a risk of injury. This can be best achieved by using physical barriers and supervision to prevent children's access to hazards, and by designating "safe play" areas for children. These recommendations are designated with "junior" to easily differentiate them from those for older children, which are designated as "senior."

Younger Children (<6 Years): Recommendation One

Identify *alternative childcare arrangements* to keep children away from the farm worksite, especially when animals and equipment are present.

To promote parents' adoption of the recommendation, it will be essential to communicate to them: (a) it is normative for young children to act unpredictably, so at these young ages they are especially at risk for interacting with farm hazards if they are near the parent while the parent is working; (b) the fallacy of believing they can adequately simultaneously attend both to their work and their child, and the overwhelming evidence that having the child proximally to them when working *increases* the child's risk of serious injury; and (c) that having an older sibling look after a younger one does not constitute appropriate alternative childcare arrangements. Making them aware that the risk of injury is generally increased, not decreased, by having an older sibling supervise is essential, as is helping them to understand how this risk arises.[59,60] Very likely, making parents aware of the potential benefit of alternative childcare arrangements is not likely to be sufficient.

Effective implementation of this recommendation will also necessitate further research. First, research is needed to better understand parent receptivity to the notion that alternative childcare arrangements are needed to ensure a young child's safety. Simply stated, if parents are not convinced that this is the best solution to the issue of child safety on farms, then they will not adopt this recommendation.

Second, research is needed to identify potential psychological barriers to parents' use of alternative childcare if it were provided; a resource is only worth offering if the intended audience makes good use of it. Hence, one must determine what attitudes, beliefs, or values farm families hold that would undermine their using alternative childcare if it were provided (e.g., some parents are opposed to daycare in principle or because they hold a personal belief that children should be raised "within" the family). Related to this is the need for research to

determine *who* farm families would consider as an acceptable caregiver substitute for the parent (e.g., only someone within their church or their community), and if there are particular conditions under which they would consider this option especially important (e.g., they may view this as useful only during harvest times).

Finally, one must also identify practical barriers that might make it difficult for farm families to utilize alternative care arrangements if they are available. Research is needed to identify the scope of these, but it is likely these will include geographic distance and cost of caregiving. In addition, having access to skilled labor that can actually provide childcare may be an issue. In rural communities, for example, there may be limited availability of individuals who are willing, able, and trained to provide adequate childcare.

Younger Children (<6 Years): Recommendation Two

Because no parent can provide constant supervision at all times, it is important to identify *effective physical barriers* to prevent children from accessing hazards that are part of the typical farm environment (e.g., animals, hayloft, drainage ditches) and that children may come within the vicinity of during the course of a typical day.

Research that utilizes evidence outlining common mechanisms of injury as a function of child age may help to identify the most common hazards that frequently lead to injury so one can prioritize the installation of barriers based on a child's age. In addition, conducting research with engineers and human factors specialists will be important for identifying "best designs" for such barriers so that cost and safety specifications are appropriately balanced and products are developed that are appealing to caregivers in order to maximize usage.

To promote parents' adoption of the recommendation, it will be essential to communicate to parents: (a) that teaching young children "rules" aimed at having the child not touch or interact with hazards is not an adequate substitute for a physical barrier because rules do not prevent injury at these young ages—children often know rules but do not follow them when left unsupervised[61]; and (b) that barriers do work to prevent injury (e.g., a stair gate is the only strategy proven effective to prevent fall injuries for young children[9]). It is acknowledged that a lack of available appropriate barrier options may limit the implementation of this recommendation. Hence, advocating for product design and development may be a necessary first step. Additionally one must emphasize the need for close/constant supervision for conditions for which a barrier cannot be implemented.

Younger Children (<6 Years): Recommendation Three

Designate "safe play" areas for young children and communicate that these are the preferred areas for young children when outside. This would be comparable to designating a playroom in a home, which parents often do to create a very high standard for safety (e.g., all hazards are removed, only safe toys are provided), but in a limited area which makes it an easier safety strategy to implement and easier to provide supervision.[24] Another benefit of "safe play" areas is that young children will learn that these are their "places" and to respect that their recreation activities differ from those of others in the family who are not in these areas.

To promote parents' adoption of this recommendation it will be helpful to provide resources to aid in creating a safe play area (e.g., blueprints for what some might look like, including a listing of resources and photos, are available online at the Creating Safe Play Areas website[62]). Developing prepackaged "kits" to make it easy to purchase all the materials required to create such a space (much like one can purchase kits to install a play structure in the back yard) also would likely facilitate uptake of this recommendation.

Younger Children (<6 Years): Recommendation Four

Provide a formal Safety & Supervision training program for caregivers. This can provide basic training in first aid and cardiopulmonary

resuscitation (CPR) and also emphasize risk awareness (e.g., injury stories are very effective for communicating injury risk to parents[46]), while providing information about effective supervision strategies.

Recently, Morrongiello and colleagues[63] developed and completed a randomized, controlled trial evaluation of a video that aims to increase caregivers' home supervision of young children in nonfarm contexts. Results indicate that the video is effective in positively impacting parents' beliefs about the value of active supervision and improving their supervisory practices. Research could be conducted to develop a similar supervision audiovisual resource specific to farm contexts. Dissemination of such a resource could be via the Internet and usage of the program could be monitored remotely (e.g., access of the website could be monitored and measured by using Google Analytics) in order to evaluate uptake and the usefulness of this intervention approach for reaching families on farms.

In addition, there is an ongoing evaluation of a website aimed at improving supervision by older siblings (Schell and Morrongiello, unpublished). If this program proves effective in achieving its aims (i.e., enhancing understanding of motor development and implications for injury risk; improving hazard identification and risk appraisal skills; improving older children's ability to manage younger siblings' difficult behaviors like non compliance with safety requests; and enhancing active supervision), then content adjustments could be made (e.g., to include farm hazards), and it could be made available on the internet for access by farm families.

Younger Children (<6 Years): Recommendation Five

When more than one adult is present with a child, they should clearly designate who is in charge of supervising the child and explicitly discuss this to prevent a diffusion of responsibility effect resulting in no one assuming this responsibility. Publicizing targeted communications that are easy to recall may help to raise awareness of the importance of this issue. A poster, for example, could communicate: *There's at least two* [picture of two or more children] *. . . so is it me or you* [picture of two adults talking and looking at the children]*?*

Older Children (6 Years and Older)

To reduce injuries among older children, one has to focus more on work-related hazards and risks. Hence, although supervision plays less of a role in safety for older than younger children, it is *still* relevant, which is why supervision guidelines are indicated in NAGCAT for teenagers doing different tasks. It should be emphasized, however, that because of the increasing independence youth experience as part of normal development, they share the responsibility for their safety with parents and employers. Hence, developing a thorough understanding of their views is likely to be an important aspect of any injury prevention initiative that aims to enhance their safety in agricultural settings.

Older Children (6 Years and Older): Recommendation One

Because the presence of a supervisor has been shown to reduce children's risk taking,[64–66] having a supervisor present when children and teens are engaged in farm work may reduce injuries. Moreover, because boys are more likely to operate equipment, and they typically engage in greater risk taking than girls, the presence of a supervisor may be particularly effective to reduce equipment-related injuries among boys. In addition, although many injuries to older children occur from unexpected environmental events, it could be that an experienced farmer/supervisor who is present would be better skilled at anticipating such events, thereby preventing injury to youth.[67]

The NAGCAT provides important guidelines about tasks appropriate for youth at different ages, as well as suggesting minimum supervisory practices for each task; similar guidelines are given in the Safety Guidelines for Hired Adolescent Farmworkers. These guidelines are important for caregivers and employers to be familiar with, but they should also be directed specifically to youth so that they realize the

scope of risk and monitoring suggestions for each task. Moreover, although these are "guidelines" and not formal mandated statutes, they may prove useful in deciding on the appropriateness of charging caregivers in the event of a serious child injury. To the extent that the safety of minors is the responsibility of caregivers and employers, child protection services should play a role anytime children are seriously injured, whether in agricultural or nonagricultural settings. Laying charges for failing to keep a child safe may not have the support of the general public, but it may prove effective in raising awareness of the vulnerability of youth to injury and who has the responsibility for their safety. The debate about responsibility and accountability and whether adults should be formally charged when youth in their care are seriously injured is not specific to the agricultural domain. For example, similar debates are occurring in the sports domain regarding coaches.[68] Utilizing social marketing approaches to raise awareness of children's risk of injury in agricultural contexts and the responsibility of caregivers and employers to adequately supervise and prevent injuries should be a part of any intervention framework aimed at reducing the burden of injury for youth in agricultural contexts.

Older Children (6 Years and Older): Recommendation Two

Having guidelines that aim to enhance youths' safety when engaged in farm tasks (e.g., NAGCAT) is necessary but not sufficient to enhance their safety. What is also needed is a clear understanding of youths' perspectives on issues of risk and supervision when they are engaged in farm work. Teenagers can be very challenging when they are not in agreement with an adult's request or demand. It is essential, therefore, that research be conducted to better understand the meaning youth ascribe to being directly supervised when doing farm work, and if/how they behave to actively encourage or discourage such supervisory practices.

In addition, research is also warranted to identify, from the youth's perspective, those messaging approaches that would be most effective at raising awareness of injury risks and hazards to watch for in executing different tasks. Would it work best, for example, to expose them to: youth injury statistics, individual injury stories that relate to different tasks, hazard explanations based on physics principles, or to relate consequences of injury to things they care a great deal about at this developmental stage (e.g., how they look, their ability to engage in movement-based activities with friends like dancing or driving a car, their ability to keep working and earn an income so they have some independence)? Not surprisingly, youth often have a different view about advertising and messaging than adults who are creating those messaging strategies. Hence, it is critical to involve them in developing any social marketing campaigns that aim to target youth directly. *SMARTRISK* is an organization in Toronto, Canada, for example, that has used this type of participatory youth approach and has generated quite innovative and effective messaging for youth.

CONCLUSION

It is evident from the literature reviewed that the nature and scope of supervision influences children's risk of injury in agricultural contexts. Improvements in supervision can prevent pediatric injuries in agricultural contexts, but effecting such changes can be challenging. Limited economic and practical resources can make it difficult for families to implement changes they may acknowledge would enhance their child's safety (e.g., using alternative childcare arrangements). In addition, attitudinal barriers can exist (e.g., based on a family history of particular supervision practices) that undermine changes in beliefs regarding children's supervision needs and the adoption of new practices in agricultural contexts. Conducting systematic research to more fully understand the attitudes and beliefs farm families hold about supervision and child injury risk is important to ensure that programs to address the supervision needs of children in agricultural settings are adopted by families. In addition, blending these supervision-enhancing interventions with

those aiming to improve usage of barriers to prevent access to hazards, particularly by young children, is important because both approaches effectively complement one another. It is essential, however, that if this dual-type intervention approach is adopted, research be conducted to ensure that caregivers realize that barriers should not be used as a substitute for supervision but as a complement to actively supervising. Implementing both strategies together has substantial potential to reduce the risk of injury to young children in agricultural contexts.

REFERENCES

1. Morrongiello BA, Lasenby J. Supervision as a behavioral approach to reducing injury risk. In: Gielen A, Sleet D, DiClemente R, eds. *Handbook of Injury Prevention: Behavior Change Theories, Methods, and Applications*. San Francisco, CA: Jossey-Bass; 2006: 395–418

2. Morrongiello BA, Zdzieborski D, Lasenby-Lessard J, Sandomierski M. Video messaging: what works to persuade mothers to supervise young children more closely to reduce injuries? *Soc Sci Med*. 2009;68:1030–1037.

3. Schwebel D, Summerlin A, Bounds M, Morrongiello BA. The Stamp-in-Safety Program: a behavioral intervention to reduce behaviors that can lead to unintentional playground injury in a preschool setting. *J Pediatr Psychol*. 2006;31:152–162.

4. World Health Organization. *Child and Adolescent Injury Prevention: A Global Call to Action*. Geneva: World Health Organization; 2005.

5. Adekoya A, Pratt SG. *Fatal Unintentional Farm Injuries Among Persons Less Than 20 Years of Age in the United States: Geographic Profiles.* Cincinnati, OH: National Institute for Occupational Safety and Health; 2001. DHHS (NIOHS) Publication No. 2001–131. Available at: http://www.cdc.gov/niosh/childag/pdfs/Childag2.pdf. Accessed May 29, 2009.

6. Brison RJ, Pickett W, Berg RL, Linneman J, Zentner J, Marlenga B. Fatal agricultural injuries in preschool children: risk, injury patterns, and strategies for prevention. *Can Med Assoc J*. 2006;174:1723–1726.

7. Mitchell RJ, Franklin RC, Driscoll TR, Fragar LJ. Farm-related fatalities involving children in Australia, 1989–92. *Aust J Public Health*. 2001;25:307–314.

8. Tiwari PS, Gite LP, Dubey AK, Kot LS. Agricultural injuries in central India: nature, magnitude, and economic impact. *J Agric Saf Health*. 2002;8:95–111.

9. Hendricks KJ, Myers JR, Layne LA, Goldcamp EM. Household youth on minority operated farms in the United States, 2000: exposure to and injuries from work, horses, ATVS and tractors. *J Saf Res*. 2005;36: 149–157.

10. Reed DL, Claunch DT. Nonfatal farm injury incidence and disability to children: a systematic review. *Am J Prev Med*. 2000;18:70–79.

11. Centers for Disease Control and Prevention. *NIOSH Alert: Prevention Deaths, Injuries and Illnesses of Young Workers.* Cincinnati, OH: National Institute for Occupational Safety and Health; 2003. DHHS (NIOSH) publication No. 2003–128. Available at: http://www.cdc.gov/niosh/docs/2003128/pdfs/2003128.pdf. Accessed May 16, 2011.

12. Marlenga B, Berg RL, Linneman J, Brison R, Pickett W. Changing the child labor laws for agriculture: impact on injury. *Am J Public Health*. 2007;92:276–282.

13. Hendricks KJ, Layne LA, Goldcamp EM, Myers JR. Injuries to youth living on U.S. farms in 2001 with comparison to 1998. *J Agromedicine*. 2005;10:19–26.

14. Factsheet. National Children's Center for Rural and Agricultural Health and Safety, 2010. Available at: http://www.marshfieldclinic.org/NCCRAHS/. Accessed March 12, 2012.

15. Castillo S, Hard D, Myers J, Pizatella T, Stout N. A national childhood agricultural injury prevention initiative. *J Agric Saf Health*. 1998;1:183–191.

16. DeMuri GP, Purschwitz MA. Farm injuries in children: a review. *WMJ.* 2000;99:51–55.

17. Marlenga B, Brison RJ, Berg R, Lineeman J, Zentner J, Pickett W. Evaluation of the North American guidelines for children's agricultural tasks using a case series of injuries. *Inj Prev*. 2004;10:350–357.

18. Pickett W, Brison RJ, Berg RL, Zentner J, Linneman J, Marlenga B. Pediatric farm injuries involving non-working children injured by a farm work hazard: five priorities for primary prevention. *Inj Prev*. 2005;11: 6–11.

19. Rivara FP. Fatal and non-fatal farm injuries to children and adolescents in the United States, 1990–1993. *Inj Prev*. 1997;3:190–194.

20. Dowd DM, Keenan HT, Bratton SL. Epidemiology and prevention of childhood injuries. *Crit Care Med*. 2002;30:385–392.

21. Fathallah FA, Chang JH, Pickett W, Marlenga B. Ability of youth operators to reach farm tractor controls. *Ergonomics*. 2009;51:685–694.

22. Marlenga B, Pickett W, Berg RL. Assignment of work involving farm tractors to children on north american farms. *Am J Ind Med*. 2001;40:15–22.

23. Marlenga B, Pickett W, Berg RL, Murphy D. Operational characteristics of tractors driven by children on farms in the United States and Canada. *J Agric Saf Health*. 2004;10:17–25.

24. Morrongiello BA, Ondejko L, Littlejohn A. Understanding toddlers' in-home injuries: I. Context, correlates, and determinants. *J Pediatr Psychol*. 2004;29: 415–431.

25. Morrongiello BA, Ondejko L, Littlejohn A. Understanding toddlers' in-home injuries: II. Examining parental strategies, and their efficacy, for managing child injury risk. *J Pediatr Psychol*. 2004;29:433–446.

26. Rimsza M, Schackner R, Bowen K, Marshall W. Can child deaths be prevented? The Arizona Child Fatality Review Program experience. *Pediatrics*. 2002;110:e11.

27. Hawk C, Gay J, Donham KJ. Rural Youth Disability Prevention Project Survey: results from 169 Iowa farm families. *J Rural Health*. 1991;7:170–179.

28. Garbarino J. Preventing childhood injury: developmental and mental health issues. *Am J Orthopsychiatry*.1988;58:25–45.

29. Haberal MA. An eleven-year survey of electrical burn injuries. *J Burn Care Rehabil*. 1995;16:43–48.

30. Landen MG, Bauer U, Kohn M. Inadequate supervision as a cause of injury deaths among young children in Alaska and Louisiana. *Pediatrics*. 2003;111:328–331.

31. Ozanne-Smith J, Ashby K, Stathakis VZ. Dog bite and injury prevention—analysis, critical review, and research agenda. *Inj Prev*. 2001;7:321–326.

32. Peterson L, Stern BL. Family processes and child risk for injury. *Behav Res Ther*. 1997;35:179–190.

33. Pollack-Nelson C, Drago DA. Supervision of children aged two through six years. *Inj Control Saf Promot*. 2002;9:121–126.

34. Peterson L, Ewigman B, Kivlahan C. Judgments regarding appropriate child supervision to prevent injury: the role of environmental risk and child age. *Child Dev*. 1993;64:934–950.

35. Gitanjali S, Brenner R, Morrongiello BA, Haynie D, Rivera M, Cheng TL. The role of supervision in child injury risk: definition, conceptual, and measurement issues. *Inj Control Saf Promot*. 2004;11:17–22.

36. Morrongiello BA. The role of supervision in child-injury risk: assumptions, issues, findings, and future directions. *J Pediatr Psychol*. 2005;30:S36–S52.

37. Roberts I. Parental supervision: a popular myth. *Inj Prev*. 1996;2:9–10.

38. Morrongiello BA, Corbett M. The Parent Supervision Attributes Profile Questionnaire: a measure of supervision that is relevant for understanding children's risk of unintentional injury. *Inj Prev*. 2005;12:19–23.

39. Petrass LA, Finch CF, Blitvich JD. Methodological approaches used to assess the relationship between parental supervision and child injury risk. *Inj Prev*. 2009;15:132–138.

40. Reading R, Langford IH, Haynes R, Lovett A. Accidents to preschool children: comparing family and neighborhood risk factors. *Soc Sci Med*. 1999;48:321–329.

41. Shannon A, Brashaw B, Lewis J, Feldman W. Nonfatal childhood injuries: a survey at the Children's Hospital of eastern Ontario. *CMAJ*. 1992;146:361–365.

42. Morrongiello BA, Kane A, Zdzieborski D. "I think he is in his room playing a video game": parental supervision of school-age children at home. *J Pediatr Psychol*. 2011;36:708–717.

43. Morrongiello BA, Corbett M, Kane A. A questionnaire measure that relates to elementary-school children's risk of injury: the Supervision Attributes and Risk Taking Questionnaire (SARTQ). *Inj Prev*. 2011;17:189–194.

44. Morrongiello BA, Corbett M, McCourt M, Johnston N. Understanding unintentional injury-risk in young children. I. The nature and scope of caregiver supervision of children at home. *J Pediatr Psychol*. 2006;31:529–539.

45. Morrongiello BA, Corbett M, McCourt M, Johnston N. Understanding unintentional injury risk in young children. II. The contribution of caregiver supervision, child attributes, and parent attributes. *J Pediatr Psychol*. 2006;31:540–551.

46. Morrongiello BA, Corbett M, Brison RJ. Identifying predictors of medically-attended injuries to young children: do children or parent behavioral attributes matter? *Inj Prev*. 2009;15:220–225.

47. Canadian Red Cross Society. *Drownings Among 1 To 4 Year Old Children in Canada: A High Risk Group for Water-Related Fatalities*. Special Research Report. Ottawa, ON: Canadian Red Cross Society; 1994.

48. Cody BE, Quraishi AY, Dastur MC, Mickalide AD. *Clear Danger: A National Study of Childhood Drowning and Related Attitudes and Behaviors*. Washington, DC: National SAFE KIDS Campaign; 2005. Available at: http://www.safekids.org/NKSW.cfm. Accessed April 14, 2005.

49. Moran K. Parent/caregiver perceptions and practice of child water safety at the beach. *Int J Inj Contr Saf Promot*. 2009;16:215–221.

50. Munro SA, Van Niekerk A, Seedat M. Childhood unintentional injuries: the perceived impact of the environment, lack of supervision and child characteristics. *Child Care Health Dev*. 2006;32:269–279.

51. Morrongiello BA, Klemencic N, Corbett M. Interactions between child behavior patterns and parent supervision: implications for children's risk of unintentional injury. *Child Dev*. 2008;79:627–638.

52. Morrongiello BA, Schwebel DC. Gaps in childhood injury research and prevention: what can developmental scientists contribute? *Child Dev Perspect*. 2008;2:78–84.

53. Morrongiello BA, Marlenga B, Berg R, Linneman J, Pickett W. A new approach to understanding pediatric farm injuries. *Soc Sci Med*. 2007;65:1364–1371.

54. Morrongiello BA, Dayler L. A community-based study of parents' knowledge, attitudes, and beliefs related to childhood injuries. *Can J Public Health*. 1996;87:383–388.

55. Guilfoyle S.*Caregiver Perceived Self-Efficacy and Supervision in Childhood Unintentional Injury Prevention: The Moderating Role of Developmental Knowledge* [dissertation]. Kent, OH: Kent State University, College of Arts and Sciences, Department of Psychology; 2009. Available at: http://etd.ohiolink.edu/

view.cgi?acc_num=kent1244735628. Accessed June 2, 2011.

56. Nelson WE, Vaughn VC, eds. *Nelson Textbook of Pediatrics*. 11th ed. Philadelphia: WB Saunders; 1979;284–287.

57. Jimenez M. Alberta parents charged with negligence in son's bike death: lawyers surprised by arrest. *The National Post*. September 20, 1999:2.

58. Kelley J, Stauffer C. Farmer sentenced for son's death. *Lancaster New Era*. xx, 2006:3. Available at: http://lancasteronline.com/article/local/27060_Farmer-sentenced-for-son-s-death.html. Accessed May 16, 2011.

59. Morrongiello BA, Schell S, Schmidt S. "Please keep an eye on your younger sister": sibling supervision and young children's risk of injury. *Inj Prev*. 2011;16:398–402.

60. Morrongiello BA, Schmidt S, Schell S. Sibling supervision and young children's risk of injury: a comparison of mothers' and older siblings' reactions to risk taking by a younger child in the family. *Soc Sci Med*. 2010;71:958–965.

61. Morrongiello BA, Midgett C, Shields R. Don't run with Scissors: young children's knowledge of home safety rules. *J Pediatr Psychol*. 2001;26:105–115.

62. Marshfield Clinic. Creating Safe Play Web site. 2011. Available at: http://www.marshfieldclinic.org/proxy/MCRF-Centers-NFMC-keyprojects-booklet-safeplay-v3.1.pdf. Accessed May 4, 2011.

63. Morrongiello BA, Sandomierski M, Zdzieborski D, McCollum H. A Randomized Control Trial (RCT) evaluating the impact of the *Supervising for Home Safety Program* on parent appraisals of injury risk and need to actively supervise. *Health Psychology.* In press.

64. Barton B, Schwebel D. The roles of age, gender, inhibitory control, and parental supervision in children's pedestrian safety. *J Pediatr Psychol*. 2007;32:517–526.

65. Harrell W. Dangerous activities by children in grocery carts: is adult supervision important? *Psychol Rep*. 2003;92:957–962.

66. Schwebel D, Bounds M. The role of parents and temperament on children's estimation of physical ability: links to unintentional injury prevention. *J Pediatr Psychol*. 2003;28:505–516.

67. Fischer RM, Lee CB, Chadwick K, Miller ME. *Safety Guidelines for Hired Adolescent Farm Workers*. Marshfield, WI: Marshfield Clinic; 2009.

68. Emery CA, Hagel B, Morrongiello BA. Injury prevention in child and adolescent sport: whose responsibility is it? *Clin J Sport Med*. 2006;16:514–521