

# Childhood Agricultural Injuries

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## Children and Agriculture: Searching Beyond the News Clippings

*June 29, 2002, Demolition on Farm Takes Area Teen's Life.*<sup>1</sup> "Silo collapse killed a rural boy. At 6:23 pm, the County Communications Center was notified of a 14-year old youth seriously injured by falling debris from a building. First responders transported James from the farm scene to the area Medical Center where he died as a result of massive head and chest injuries. The Sheriff's investigation indicates the youth and his 16-year-old brother were demolishing a 30-foot-high concrete stave silo when it collapsed unexpectedly. James sought shelter from the falling silo in the adjacent barn, which was also in the process of being dismantled. The collapsing silo fell against the end of the barn, breaking a large hand hewn oak beam that fell on him. James had recently completed 8th grade at Webb Middle School. He enjoyed soccer, hunting, and biking. He is survived by his parents and one brother; as well as grandparents, many aunts, uncles and cousins."

*September 18, 2002, Boy Killed in Tractor Accident.*<sup>2</sup> "An 11-year-old boy was killed when a tractor he was operating flipped over and pinned him underneath, according to local deputies. The accident occurred about 7:45 pm. An ambulance and medical helicopter was called to the scene. Steven was discovered pinned under the tractor by his 15-year-old brother who had come to check on him. Medical personnel were unable to revive the boy at the scene and he was later pronounced dead. It appeared as though the boy was driving the tractor on a steep incline when it flipped over, the sheriff's official said."

Grief over a preventable death of a child often follows, as in a tragic sequela to the previous event: *November 5, 2002, Man Kills Self in Hospital.*<sup>3</sup>

"Officers were called to Sacred Heart Hospital after a shooting on a mental health ward. Police haven't determined how a handgun got into a patient's room. A 43-year old man had been under treatment for mental strain and took his own life. His 11-year old son had died two months earlier when a tractor flipped over and pinned him beneath."

*March 19, 2003, Farm Accident Claims Life of Three-Year-Old.*<sup>4</sup> "The North Dakota County Deputy Sheriff was called to a farm accident on Saturday evening. Three-year-old Alexander had been accidentally run over, crushed by a Bobcat skidsteer loader, operated by his older brother. The juvenile was cleaning the dairy farm yard with the Bobcat and he did not know the toddler was behind him. Alexander was pronounced dead on the scene. Survivors include his parents, four brothers, maternal grandparents, several aunts, uncles and cousins."

*April 23, 2003, Local Teen Dies in Tractor Rollover.*<sup>5</sup> "A 15-year old boy, was killed Monday when the tractor he was driving apparently pinned him underneath, according to the Sheriff's Department. A preliminary investigation indicates Kevin was trying to use a tractor to move a trailer that was stuck in a field. As Kevin tried to move the trailer, the tractor he was driving flipped over backward. He was found pinned under the machine by a friend who went looking for him after he didn't return before dark. Fire and rescue personnel responded to the scene and extricated him."

*October 14, 2004, Child Killed in Accident on Farm.*<sup>6</sup> "A 3-year-old child was killed in a farm-related accident Wednesday morning in south central Wisconsin. Preliminary autopsy results state the child died of multiple trauma. He became entangled in the apron gear of a forage wagon, a large self-unloading wagon with multiple moving parts. Upon arrival, emergency workers discovered that the child had become entangled in the equipment. The County Medical Examiner pronounced the child dead at the scene. Parents later explained the child had been with his uncle at the time of the accident."

*October 15, 2004, Amish Girl Dies in Accident on Family Farm.*<sup>7</sup> "A 5-year-old Amish girl died of injuries suffered in an accident on her family's farm in Iowa on Friday. Karlene was playing outside when a piece of metal her father uses in welding fell on her, according to the County Sheriff's detective. The farm is also the site of the family Welding & Equipment business. The detective described a 7-foot-tall, T-shaped frame used to hang metal pieces on when they're being welded. 'It was standing upright by his shop, it fell over. I assume the kids were probably playing and for whatever reason, it fell over.' The child died at the scene."

These actual cases, all reported in public newspapers, are just a sampling of the tragedies that occur on farms and ranches across the US. The fatalities have striking similarities, such as siblings working together, inadequate adult supervision, and farm machinery designed for adults who willingly choose to work in one of our nation's most dangerous occupation.<sup>8</sup> Beyond the news clippings, is the unreported psychological, social and financial toll that often reaps a devastating impact on survivors, especially parents.

In addition to the annual toll of child fatalities that occur once every three to four days on US farms,<sup>9</sup> data reveal that each day, about 62 children are injured on farms.<sup>10</sup> No other occupation in the US can claim this toll on children.

This chapter provides an overview of the epidemiology of childhood

agricultural fatal and non-fatal injuries (work-related and non-work-related), including data sources and limitations of data. We then describe common injury risk factors among children involved in agricultural work as well as children who are not working, but are victims of agricultural injuries. This is followed by a description of injury prevention strategies for working as well as non-working children. Advocacy efforts for children on farms were formally introduced two decades ago, trailing behind those of other child safety concerns. The major advocacy initiatives are described, followed by recommendations for action.

## Epidemiology of Injuries

*Population at Risk.* In 2001, there were approximately 1.1 million children living on farms in the United States.<sup>11</sup> More than half these children worked on the farm, with the highest proportion of youth workers between the ages of 10 and 15 years.<sup>11</sup> In addition, more than 400 000 youth were hired to work on these farms in 2001.<sup>12</sup>

*Fatalities.* There is no comprehensive national database of childhood agricultural fatalities in the United States and descriptions of agricultural injury events are somewhat limited.<sup>13,14</sup> Based on the National Center for Health Statistics Mortality Files, it is estimated that more than 100 children die each year on farms and ranches,<sup>9,15</sup> however, there are no estimates on the proportion of these deaths that are work-related. Farm machinery is the leading source of fatal injury, followed by drowning.<sup>9,15</sup> Males account for nearly 90% of the fatal injuries on farms.<sup>9,15</sup> Youth 15–19 years experience the most fatal injuries (34%) followed by children less than 5 years of age (25%).<sup>9,15</sup> The greatest proportion of deaths occurs in the Midwest and the Southern United States.<sup>9,15</sup>

There is no surveillance system to monitor youth worker fatalities in agriculture on an annual basis at either the national or state level. Several studies have tried to identify the scope of the problem using typical occupational fatality databases, but have recognized the fact that agricultural youth fatalities are poorly captured.<sup>16–18</sup> The Census of Fatal Occupational Injuries (CFOI) managed by the Bureau of Labor Statistics (BLS) is a multiple record based census of occupational fatalities covering all industries, occupations, and ages of workers.<sup>19</sup> The National Traumatic Occupational Fatalities (NTOF) is a death certificate based census of occupational fatalities maintained by the National Institute for Occupational Safety and Health (NIOSH) that includes workers 16 years and older.<sup>20</sup> Both CFOI and NTOF show that the risk for fatal injury for young agricultural workers is three to four times that of young workers in other workplaces.<sup>17,21</sup> Agricultural youth worker fatalities also differ from other work place fatalities in that half the workers fatally injured in agricultural production are younger than 15 years and are working on the family farm/ranch.<sup>22</sup> Tractors are the leading source of death for youth working in agriculture and male workers account for nearly all the fatalities.<sup>17</sup>

Castillo and colleagues conducted a comprehensive analysis of the CFOI data for fatal injuries to youth workers by agricultural sector.<sup>16</sup> Nearly half the fatally injured youth were working in a family business. Crop production was the agricultural sector that accounted for the most deaths

(52%) followed by livestock production (31%).<sup>16</sup> Tractors were the leading source of fatalities and males accounted for nearly all the fatalities. Similar to other data sources, nearly half the fatalities occurred in the Midwest (46%) followed by the South (22.3%).<sup>16</sup>

*Emergency Department Visits.* National estimates of non-fatal youth agricultural injuries requiring emergency room visits are limited. Two studies examined emergency department visits using the National Electronic Injury Surveillance System (NEISS).<sup>9,23</sup> NEISS is a surveillance system operated by the US Consumer Product Safety Commission for the primary purpose of monitoring consumer product related injuries.<sup>24</sup> The data are collected from a probability sample of hospitals with emergency departments and do not necessarily represent rural hospitals.

Based on the NEISS data, it is estimated that around 22 000 children were treated in emergency departments annually and that approximately 5400 were work-related injuries.<sup>9,23</sup> Males sustained the overwhelming majority of injuries and tractors were the leading consumer product involved in farm injuries.<sup>9</sup> The 15–19 year age group had the highest rate of farm injuries requiring emergency department treatment, followed by the 10–14 year age group.<sup>9</sup>

*Restricted Activity Injuries.* There is no comprehensive national database of childhood injuries that captures injuries of varying severity. However, as a part of the *Childhood Agricultural Injury Prevention Initiative*,<sup>25</sup> the National Agricultural Statistics Service conducted a national childhood agricultural injury survey for NIOSH to assemble a cross-sectional picture of injuries that occur to youth less than 20 years of age.<sup>10</sup> The telephone survey was conducted with a stratified random sample of 50 000 farms and ranches in the United States. Farm operators were asked about injuries that occurred on the farm operation in 2001 that result in at least 4 hours of restricted activity.<sup>10</sup>

An estimated 22 648 childhood agricultural-related injuries occurred on farms in 2001, a decline of about 11 000 injuries compared to the finding from the previous survey in 1998.<sup>10,26</sup> The number of farms declined over that same time period, so the resultant injury rate was virtually unchanged.<sup>10,26</sup> In 2001, 75% of the injuries were sustained by youth who lived on the farm.<sup>10,26</sup> Thirty-seven percent of the youth were injured while performing farm work, with the remainder classified as non-work injuries.<sup>10</sup> Males comprised the largest proportion of injured youth (62%), as did the age group 10–15 years (46%). The Midwest and the South accounted for 79% of the non-fatal childhood farm injuries.<sup>10</sup>

## Risk Factors for Childhood Agricultural Injuries

The classic Haddon matrix of agent, host, and environment,<sup>27</sup> and modifications of its use as proposed by Runyan<sup>28</sup> and Rivara<sup>29</sup> depict risk factors and their underlying etiology in the pre-event, event, and post-event phase of any injury. Studying injury events from this public health framework offers insights that can guide injury prevention interventions. In this chapter's first agricultural case report, the agent of injury was the energy from the force of a collapsing farm silo and adjacent building structure, the host was a 14-year old boy, untrained in demolition mechanics, and the environ-

ment was an unsupervised, dangerous work site.

Stallones and Gunderson<sup>30</sup> were the first to apply the Haddon theoretical framework to childhood agricultural injuries when they pieced together available data sources and demonstrated how the matrix of agent, host and environment could identify prevention strategies. Yet, applicability of this matrix for proposing agricultural injury prevention strategies is limited for two primary reasons. First, there is a wide spectrum of agricultural conditions, many of which have no control mechanisms (eg, weather). Second, a parent or other adult bears accountability for a minor's presence in a hazardous work setting, thus, the principle intervention is to modify underlying adult decisions, rather than address modification of the agent, host, or environment. A brief description of those risk factors most amenable to interventions for preventing childhood agricultural injuries are described in the context of children involved in agricultural work, followed by children exposed to agricultural work hazards while not actively engaged in work.

### Working Children and Adolescents

Worldwide, agriculture is the occupation most likely to involve children.<sup>31</sup> Unlike most occupational settings, it can be difficult to separate bona fide work from non-work activities. A traditional farmstead in the US includes the home contiguous with the worksite where children have open access to both. To make matters more complex, there can be problems distinguishing when and where labor regulations and safety standards apply. These factors complicate injury data collection as well as the design and implementation of injury prevention strategies.

### Vehicles of Injury among Working Youth

Data from several sources consistently depict the most common vehicles of injuries and fatalities on farms. Farm machinery, including tractor rollovers (victim is on the tractor when it tips over) and runovers (victim is stationary on the ground or falls off a moving tractor, then is crushed underneath a tractor wheel), account for more than one-third of deaths to youth less than 20 years.<sup>15</sup> Many engineering designs for improving tractor and machinery safety on farms have been introduced by manufacturers over the past 50 years. Rollover protective structures (ROPS), combined with seatbelts are recommended for all tractors, but are mandatory in only a few situations in the US.<sup>32</sup> Likewise, safety guards for rotating machinery parts are provided by manufacturers and recommended for safety, but unlike industry settings, there are few mandates to enforce these standard safety features.

Since 1968 when the Hazardous Occupations Order for Agriculture specified restrictions to children's work, the US Department of Agriculture (USDA) has been authorized to address youth farm safety education and certification.<sup>33</sup> Local programs have been coordinated by state Cooperative Extension Service or high school agriculture instructors.<sup>33</sup> Tractor and machinery training and certification programs, consisting of about 20 hours of lecture and driving experience, are intended to improve the safety of youth at risk of tractor-related injuries. However, these training and certification programs have not been consistently implemented. Further, program evaluations have shown mixed results.<sup>34-36</sup> While engineering

improvements and labor laws might be effective interventions, a more basic issue is the adult decision (ie, work assignment to youth) that preceded the child/adolescent being on or near farm machinery and the effectiveness of training and supervision when such work is assigned.

Non-fatal work injuries among children often include livestock and horses.<sup>11,37</sup> Risk factors leading to animal injuries include inadequate fencing or other barriers, inappropriate access of children to animals, and the unpredictable and unmanageable nature of the animals themselves. Addressing these risk factors requires modification of the work setting by the farm owner in addition to training and supervision of the young worker.

*Host Characteristics.* In looking at risk factors associated with the injury host (ie the child on the farm), data sources highlight basic demographic characteristics of age, gender, farm residency status, geographic location and agricultural commodity. Research has demonstrated that children working on their family farm are at notably greater risk of injury than hired youth. Indeed, of all injuries to all youth on farms, only 8% occur to youth hired to work on non-family farms.<sup>10</sup> There are often different expectations of youth working on family farms versus those hired on non-resident farms. Farm parents sometimes perceive that growing up on a farm lends itself to being more cognizant of inherent dangers, and more capable of handling risky tasks at an earlier age.<sup>38</sup> In addition, children strive to please their parents and willingly perform tasks that exceed their abilities.<sup>39,40</sup>

Hours of work, fatigue, training and supervision are other host factors that put a child at risk of agricultural injury.<sup>41,42</sup> Interventions for addressing these host characteristics include parent and work supervisor training regarding child and youth development as well as revised regulations that would mandate limited work hours, certified training and apprenticeships.

Host risk factors also include culture, ethnicity, and assimilation into the "culture of agriculture." The past two decades have witnessed a demographic shift in agricultural workers that is not well captured in injury surveillance data. Recently, NIOSH surveillance identified 47 700 farms, or 2% of all US farms that were owned and operated by minority populations.<sup>43</sup> As the industry of agriculture opens new opportunities for niche products, minority populations have become increasingly involved in agriculture, including Hispanic/Latino immigrants, Hmong, and Anabaptist (eg, Amish, Mennonite). Children of this new workforce are engaging in work on family and non-family farms. Issues such as language barriers, basic safety and hygiene principles, housing, and transportation introduce new challenges for professionals dealing with agricultural health and safety. Behind the reported demographic risk factors specific to agriculture, are a myriad of general factors related to child development, including physical strength and psychological state, which prevail in any child safety situation.

*Environmental Factors.* A variety of factors associated with the physical and social environment of an agricultural site have been associated with childhood agricultural injuries.<sup>26,41,42</sup> Environmental factors include the agricultural commodity, geographic features such as terrain or climate, economic conditions, and training and supervision standards for workers. Awareness of the inherent risks of childhood injuries associated with different agricultural enterprises can be helpful. For example, crop production accounts for more than half of all work-related fatalities to children, includ-

ing hired youth.<sup>10,16</sup> When looking solely at youth residing on farms, livestock operations are slightly more hazardous than other enterprises.<sup>26</sup>

Training and supervision of youth working in agriculture differs from occupations such as quick service restaurants. Many industries have safety standards and compliance expectations for all employees, including young workers. This is not the case in agriculture. A recent survey of agricultural employers found that about half do not currently hire teen workers because of concern over labor regulations and requirements for monitoring and supervision.<sup>44</sup> Among those employers that do hire teen workers, the majority were interested in improving their practices related to training and supervision.<sup>44</sup> For the many youth working on family farms, supervision and training is strictly the prerogative of the parent or farm owner.

Ideally, adolescents would be hired to conduct safe, appropriate agricultural work. Training programs modeled on effective programs in other industries should be considered for agricultural settings where youth are legally hired, including seasonal jobs that fill employment needs of young workers.<sup>45</sup>

*Labor Policy.* The 2002 Census of Agriculture identified 2.1 million farms in the US<sup>46</sup> and an estimated 90% of these are exempt from enforcement of OSHA standards because they employ fewer than 11 employees.<sup>47,48</sup> It is important to note that the Department of Labor's Fair Labor Standards Act with Child Labor regulations has two primary distinctions: agricultural work and all other work.<sup>49,50</sup> Further, the Hazardous Occupations Order for Agriculture that attempts to protect youth by limiting their employment activities to non-hazardous agricultural work, has many exemptions applicable to family farms.<sup>14,49,50</sup> Thus, unlike conditions for youth employed in non-agricultural jobs, regulations and safety standards are primarily voluntary, except where youth are hired to work on non-family farms.

### Non-Working Children

Similar to conditions of youth who are working, tractors and machinery are often involved in deaths and injuries of non-working children. Young children are likely to fall from and/or be run over by tractors or farm equipment. Safety specialists strongly promote the "No Extra Rider" rule to keep young children off tractors, however, the practice of children riding on tractors or playing near tractor pathways remains common on many farms.

Following machinery and vehicles, drowning is a major cause of childhood agricultural fatalities,<sup>15</sup> and on minority farm operations, drowning is the leading cause of death to children.<sup>43</sup> Unlike urban drownings, the agricultural water source can be an irrigation ditch, farm pond for animals and wildlife, or a livestock-watering trough. Prevention strategies to minimize on-farm drownings include secure fencing or other barriers as well as close supervision around water hazards.

Falls occur frequently among children on farms, and these events are associated with high structures, tall machinery, climate, and slippery surfaces. Interventions should first address removal of children from these work settings; then address safety hazards for adults as well as children. A recent case illustrates the need for a two-step intervention. A 12-year-old girl suffered a severe head injury after falling from a hayloft. The girl was playing basketball with her siblings in a makeshift upper hayloft court. A

hay shoot floor latch broke open, resulting in her fall through the hole, crashing to a concrete floor 13 feet below. To prevent future injuries the strategy is first to prohibit children from playing in the loft and then repair the dysfunctional shoot latch to protect adults working in the area.

*Supervision.* Safety professionals state that young children injured in agricultural settings are in the "wrong place...all of the time."<sup>51</sup> Research has shown that parents justify children's presence in hazardous work settings based upon specific attitudes and subjective norms.<sup>52</sup> For example, busy farm parents allow children in the worksite so they can spend time together, supervise a child while getting work done, help a child gain a strong work ethic, and provide an opportunity for fun. The same study reported that the people most likely to influence parents' decisions are grandparents and spouse, while health professionals have little influence on such decisions. Another study, which specifically analyzed the effect of supervision on childhood agricultural injuries, noted that about half of all injurious children were being "supervised" by an adult who was actively conducting farm work at the same time.<sup>53</sup>

The availability or absence of affordable, high quality childcare services is a key determinant affecting the presence of young children in agricultural work sites. Previously, farm enterprises were generational in nature, increasing the likelihood that children could be cared for by non-working family members or neighbors. Contemporary farms typically have one or both parents employed off the farm to augment income. Thus, dependable childcare services are needed in farming communities to the same extent as their urban counterparts, yet few options exist.

### Interventions and Their Effectiveness

Concern over children being injured while living, working, or visiting farms has always been present, but a targeted effort to address these concerns was not undertaken as a national public health initiative until recently. In 1991, a Surgeon General's Conference on Agricultural Safety and Health was held in Des Moines, Iowa. During this conference, a session entitled *Intervention: Safe Behaviors Among Adults and Children* highlighted the risks faced by people, both youth and adult, involved with production agriculture.<sup>54</sup> This was followed in 1992 by a Childhood Agricultural Injury Prevention Symposium held in Marshfield, Wisconsin. The symposium was sponsored by the National Farm Medicine Center and sought to understand key issues from the different perspectives of farm parents, pediatricians, researchers, educators, engineers and the media. Participants formulated discussion points, identified areas for further consideration, and published their proceedings.<sup>55</sup>

As a follow up to the 1992 Symposium, a core of 42 individuals formed the National Committee for Childhood Agricultural Injury Prevention.<sup>13</sup> Over a 16-month period, members of the committee finalized a National Action Plan that was released in 1996 for addressing the childhood agricultural injury problem.<sup>13</sup> The National Action Plan, endorsed by more than 80 professional organizations and agricultural groups, recommended leadership, surveillance, research, education, and public policy. Committee members advocated for formal adoption of the plan and in October 1996 the US Congress endorsed the plan and targeted funding for its implementation.

The 1996 National Action Plan recommended that NIOSH serve as the lead federal agency in preventing childhood agricultural injury. In late 1996, NIOSH rolled out its National Childhood Agricultural Injury Prevention Initiative with goals to fill critical data needs; establish an infrastructure which facilitates the use of data to develop and improve upon prevention efforts; and encourage the use of effective prevention strategies by the private and public sectors.<sup>25</sup> To date, NIOSH has undertaken a number of activities to address the recommendations in the National Action Plan.<sup>56</sup> It is through this NIOSH-led initiative that the majority of intervention research and injury surveillance has been funded.

A team of Canadian scientists recently conducted a systematic review of interventions for preventing childhood agricultural injuries.<sup>57</sup> Their findings, based on a comprehensive assessment of controlled research trials and observational studies, provide valuable insights into strengths and weaknesses of some of the most prominent interventions currently in place. For example, they found that school-based programs appear to be effective at increasing short-term knowledge gain among children, especially when interactive learning methods are employed; and the popular one-day farm safety day camps demonstrate children's ability to retain selected safety messages. There were mixed results from evaluations of tractor safety training and general farm safety community-based initiatives.<sup>57</sup>

#### Interventions to Prevent Agricultural Work-Related Injuries

In 1999, the North American Guidelines for Children's Agricultural Tasks (NAGCAT) were released as a new resource to help adults match a child's physical, mental and psychosocial abilities with the requirements of agricultural jobs.<sup>58</sup> The NAGCAT enable children ages 7–16 years to have safe, meaningful work experiences in agriculture. It is important to note that the NAGCAT were developed for use in family farm settings, so they do not match up with child labor regulations or conditions where youth are employed in non-family settings.<sup>59</sup> Using the job hazard analysis framework, detailed information for 62 agricultural jobs commonly performed by children is provided in a professional resource manual along with illustrated posters for parent use.<sup>60</sup> These resources can be downloaded from a dedicated website, [www.nagcat.org](http://www.nagcat.org).

NIOSH-funded evaluation studies have demonstrated that parents' use of NAGCAT improves if dissemination is accompanied by a farm visit from a safety specialist or if child development principles are provided and promoted along with the print guidelines.<sup>61,62</sup> Further, a review of injury cases highlighted that if NAGCAT recommendations had been applied, 70% to 80% of the most serious work-related injuries could have been prevented.<sup>63</sup> The NAGCAT resources and modifications are used in the US, Canada, Scandinavia and Australia. In some cases, the NAGCAT have been tested with underserved populations, including Hispanic and Asian farmworker families.<sup>64,65</sup>

In 2001, under the direction of the USDA, a multi-faceted program was implemented to improve tractor and machinery safety training and certification for youth. The Hazardous Occupations Safety Training in Agriculture (HOSTA) initiative is currently refining a formal training program (including low-literacy resources) with a national tracking and recording

system for use where employers need verification of training by minor employees.<sup>33</sup> Refer to <http://hosta.nsc.org> for more information.

Other interventions for youth working in agriculture include information dissemination from the state Cooperative Extension Service, non-government agencies, or the Department of Labor (DOL). For example, the DOL works with OSHA to regularly update the *Youth Rules!* website at <http://www.youthrules.dol.gov/>, providing guidance to teens, parents, educators and employers.<sup>66</sup> The site includes specific information for youth working in agriculture including OSHA safety standards, pertinent labor laws, and safety tips for jobs such as tractor operations and working in confined spaces.<sup>67</sup>

### Non-Work-Related Research and Interventions

The strategy of relying on educational interventions to protect non-working children on farms is controversial. Because the farm is an occupational worksite, children who are not engaged in formal work would ideally be separated from the work setting, thus, there would be no need to educate them regarding injury prevention. Indeed, parents or responsible adults should be knowledgeable of the rationale for separating non-working children from farm worksites. While many current interventions focus on education for young children, most safety professionals promote removing young children from the worksite altogether. However, the perspective that it is inappropriate for children to be in the worksite directly conflicts with populations that practice traditional agriculture.

Off-site childcare for non-working children of farm owners and farmworkers is an ideal injury prevention option. Attempts have been made to implement rural childcare cooperative programs for farm families with mixed results. Childcare services for farm families must have flexible hours to match farmers' variable, often unscheduled, work activities. Additionally, childcare services for an agricultural population must accommodate cultural values and economic limitations of parents and guardians who depend on these services. The Redlands Christian Migrant Association (RCMA) of Immokalee, Florida, is a successful cooperative venture between growers, migrant farmworker women, and churches that provides graduated levels of programming and services for children of various ages.<sup>68</sup> After three decades of trial and error, RCMA now serves more than 5000 individuals from programs in 17 Florida counties and it is endorsed by major farm organizations such as the American Farm Bureau.

When off-site childcare is not an option for non-working children, designated safe play areas on farms are recommended.<sup>69</sup> A safe play area on a farm is a carefully planned, designated location with limited exposure to hazards such as traffic, agricultural production and environmental concerns. In 2003, Australia adopted a national child farm safety plan that included "safe play areas on farms" as a major national theme, promoting fencing and supervision in a manner consistent with their national swimming pool safety campaign.<sup>70</sup> In 2003, a US team of agricultural safety and playground safety specialists generated a detailed guide, based on playground safety and child development principles, to be used by farm owners.<sup>71</sup> *Creating Safe Play Areas on Farms* serves as a guidance document to facilitate action by farm owners when off-site childcare is not a viable option.<sup>71</sup>

The document can be downloaded from the internet at <http://www2.marshfieldclinic.org/research/children/safePlay>.

Community-based interventions, including initiatives such as Farm Safety 4 Just Kids (FS4JK) chapters where rural mothers introduce safety education for children, have been popular in many areas of the US and Canada.<sup>72</sup> While these programs are presumed to have benefits for parents and children, and many have demonstrated short-term knowledge gain, there is not definitive research to demonstrate they reduce the toll of childhood agricultural injuries.<sup>57,73,74</sup>

## Advocacy

In the early 1990s the primary advocacy efforts toward child safety on farms involved the development, endorsement, and the implementation of the National Action Plan for Childhood Agricultural Injury Prevention.<sup>13,25</sup> In order to assess the extent to which progress was being made on the National Action Plan, an in-depth assessment of activities was facilitated by the National Children's Center for Rural and Agricultural Health and Safety.<sup>75</sup>

Assessment summaries were discussed at length among 100 individuals participating in the 2001 Summit on Childhood Agricultural Injury Prevention with proceedings published one year later.<sup>69</sup> The initial 1996 plan, combined with the 2001 follow up report, have served as the primary communication tools for advocacy. NIOSH uses these reports to solicit research proposals while individuals use the reports to justify grant requests to private foundations.

Advocacy efforts have also occurred within professional organizations and non-profit groups. For example, the American Academy of Pediatrics (AAP) developed and disseminated its policy statement on Childhood Agricultural Injuries.<sup>76</sup> The AAP also published guidelines for the care of migrant farmworkers' children.<sup>77</sup> The National Institute for Farm Safety (NIFS) is the professional organization of agricultural safety practitioners, including Cooperative Extension safety specialists and insurance company safety representatives. NIFS convenes annual conferences and publishes technical papers that include research and practical applications for child safety on farms. NIFS does not have formal lobbying efforts but endorses position papers and action plans. The American Society of Agricultural Engineers (ASAE) has a primary focus on engineering solutions to agricultural hazards. Like NIFS, the ASAE develops and endorses position papers on issues such as "buddy seats" in tractors, but does not have an official advocacy arm to the organization. The American Public Health Association (APHA) indirectly addresses childhood agricultural injury prevention through two special interest group sections: Injury Control and Emergency Health Services and the Occupational Health and Safety group. APHA also supports a Young Worker Network that, if called upon, would propose and endorse policy changes to protect youth working on farms.

In the private sector, non-government organizations such as FS4JK have raised the profile of the injury problem by gaining regional and national coverage in the general media and farm press. In 2004, the Founder and President of FS4JK, Marilyn Adams, was named one of the 25 outstanding "Faces of Public Health" for her grass-roots efforts to bring national atten-

tion to the problem of children being injured and killed on farms across the US.<sup>78</sup> Advocacy groups and coalitions can learn much from this and other like organizations on how to unite professionals and lay persons together to combat children's injuries.

## Future Directions

Although progress has been made on preventing childhood agricultural injuries in the past two decades, more can be done. Action plans for general as well as child-specific agricultural safety have been developed through consensus methods involving agricultural stakeholders. The various plans include general and detailed recommendations for minimizing injuries to children on farms.

National agricultural health and safety recommendations that address child and adolescent safety are:

- *Agriculture at Risk: A Report to the Nation*<sup>79</sup>
- *Children and Agriculture: Opportunities for Safety and Health. A National Action Plan*<sup>13</sup>
- *Migrant and Seasonal Hired Adolescent Farmworkers: A Plan to Improve Working Conditions*<sup>45</sup>
- *Childhood Agricultural Injury Prevention: Progress Report and Updated National Action Plan from the 2001 Summit*<sup>69</sup>
- *National Agenda for Action: National Land Grant Research and Extension Agenda for Agricultural Safety and Health*<sup>80</sup>
- *Using History and Accomplishments to Plan for the Future: A Summary of 15 Years in Agricultural Safety and Health, and Action Steps for Future Directions*<sup>81</sup>
- *Looking Beneath the Surface of Agricultural Safety and Health: Chapter 7, Challenges, Opportunities and Ideas for the Future*<sup>82</sup>
- *National Agricultural Tractor and Safety Initiative: A Plan of the NIOSH Agricultural Safety and Health Centers*<sup>32</sup>

There is no shortage of suggestions for improving the safety of children and adults on our nation's farms and ranches. Where we fall short is in leadership and ability to enact recommendations. For a number of reasons, individuals and organizations find it difficult to implement desired strategies for childhood agricultural injury prevention. Factors such as economic farm policy, the independent nature of farming and farmers, resistance to change, and limitations in rural services prevail. For example, farm policies in the US have primarily focused on global trade, product safety, and environmental preservation, not on worker health and safety. In those cases where worker safety policy is addressed, it rarely incorporates issues of children living and working on family farms where the majority of childhood injuries occur.

Resistance to safety interventions can be compared to other areas of injury prevention such as motorcycle helmet use, where the irony is that resistance is greatest among the population with the most at stake. Another limiting factor is the obvious dissonance between safety professionals and the general farm community regarding an acceptable degree of risk in agricultural work settings. Indeed, farm owners seem to have lower expecta-

tions for occupational safety conditions than do the public health and agricultural safety professionals serving them.

*Initial Action.* In the near future, attention should be given to the young, non-working children at risk of injuries. Having affordable, accessible childcare options available and used by farm owners and parents would remove the most vulnerable children from the immediate risk of injury. Government or private-sector incentives for increasing the number and quality of rural childcare programs should be encouraged.<sup>83</sup> Parents and farm owners should be held accountable for child protection, consistent with urban parents. Finally, insurance companies should offer incentives to farm owners that physically separate children from the occupational worksite.

*Long-Term Action.* In the long run, organizational policy, public policy and regulatory changes are warranted on several fronts. Some of these policy changes include:

- National, state and organizational policies should provide financial incentives to farm owners for improving the safety environment and practices in their agricultural enterprise, especially as they affect children. Farm subsidies should be contingent upon safe working conditions. Such policies could mimic other government programs that reward agricultural producers for environmental practices; or they could be filtered through property insurers.
- Policy recommendations of the 1996 National Action Plan should be addressed. These include: mandating the restriction of youth under 18 years from operating tractors without seat belts and ROPS and restricting tractor operations on public roads to youth of 16 years or older who have a valid drivers license.<sup>13</sup>
- The Hazardous Occupations Order for Agriculture that affect youth working on farms should be updated and enforced.<sup>84</sup> Particular attention should be given to agricultural work that is highly associated with childhood morbidity and mortality.
- OSHA's regulation of farm safety equipment should be strengthened to increase the likelihood that working conditions for adults and youth meet minimum safety standards.

While we have focused heavily on the adverse outcomes of children's presence in agricultural worksites, it is important to maintain a balanced perspective. Agriculture offers many positive benefits for children. The largest youth serving organization in the US, the National FFA (formerly Future Farmers of America), was chartered by the US Congress on the principle that agriculture provides unique opportunities for young people to develop "premier leadership, personal growth, and career success."<sup>85</sup> Future research should enhance our knowledge regarding the benefits and risks of living and working on farms so that injury prevention strategies, such as stricter child labor regulations, are based on scientific findings that will stand the test of time.

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