

North American Guidelines for Children's Agricultural Tasks: Five-Year Assessment and Priorities for the Future

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Background *The North American Guidelines for Children's Agricultural Tasks (NAGCAT) are a safety resource created to assist parents in selecting safe work for their children 7–16 years of age. Since their release in 1999, a growing body of scientific evidence has accumulated regarding NAGCAT. The purpose of this project was to assess the current scientific and programmatic evidence regarding the efficacy and utilization of the NAGCAT resource in order to determine the priorities for the next 5 years.*

Methods *A systematic, evidenced-based method was employed to accomplish the project objectives. Our data sources included results from a survey of agricultural safety practitioners and researchers, a comprehensive synthesis of the peer-reviewed literature, and recommendations from a priority-setting meeting.*

Results *Five main priorities were identified: to address the perceptions and barriers associated with the use and non-use of the NAGCAT resource; to revise and re-format a core set of the guidelines; to develop a NAGCAT resource dissemination/marketing plan; to provide training and support for agricultural safety professionals and parents using NAGCAT; and to conduct further research to facilitate accomplishing these priorities.*

Conclusions *This assessment and priority identification process was successful in outlining the next steps for the NAGCAT resource. As we move toward 2010, those involved in pediatric agricultural injury prevention will have a blueprint to ensure that NAGCAT are an effective and widely used resource for preventing work-related injuries. Am. J. Ind. Med. 49:911–919, 2006. © 2006 Wiley-Liss, Inc.*

KEY WORDS: *agriculture; children; evaluation; injury prevention; priority setting*

INTRODUCTION

Pediatric agricultural injuries are an important public health problem. In the United States, a child is fatally injured on

a farm every 3 to 4 days [Rivara, 1997]. Each day, approximately 62 children are seriously injured on farms [National Agricultural Statistics Service, 2001]. No other industry in the United States exposes children of all ages to worksite hazards or such high childhood rates of premature mortality [Rivara, 1997; Castillo et al., 1999], morbidity [CDC, 1998], and disability [Reed and Claunch, 2000] due to injury. Despite these facts, most farms are exempt from occupational safety and health regulations [US Department of Labor, 2003] and child labor regulations [US Department of Labor, 2004].

In the absence of work standards for farm youth, the *North American Guidelines for Children's Agricultural Tasks* (NAGCAT) were developed to assist farm parents in assigning developmentally appropriate and safe work to their children 7–16 years of age [Lee and Marlenga, 1999]. First released in

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1999, NAGCAT are assessment tools that cover 62 different agricultural jobs commonly performed by farm children (see www.nagcat.org). Since their introduction, NAGCAT have been disseminated and are increasingly recognized as a key pediatric agricultural injury prevention resource.

Over the past 5 years, there has been considerable creative energy and financial resources expended on NAGCAT research, evaluation, and dissemination efforts (see Table I). Therefore, a growing body of scientific and programmatic evidence has accumulated regarding the content, dissemination, and efficacy of the NAGCAT resource. The overall goal of this project was to assess the current empirical and practical evidence regarding the NAGCAT resource and to use this evidence to set priorities for NAGCAT. Specifically, the objectives were to gather information from agricultural safety practitioners and researchers regarding their perceptions concerning NAGCAT, to assess and synthesize the peer-reviewed literature pertaining to the NAGCAT resource, and to identify priorities for the NAGCAT resource for the next 5 years.

NAGCAT

The NAGCAT resource was developed over a 4-year period by a team of 12 primary advisors from the United States, Canada, and Mexico. Extensive details on sequential tasks of a job, related hazards, training requirements, and supervision recommendations were generated for 62 different agricultural jobs using the job hazard analysis framework. Those details were then incorporated into assessment questions that parents can use to gauge their children's physical,

cognitive, and psychosocial ability to do the job safely. More than 70 individuals representing agricultural safety, agricultural production, child development, and other disciplines reviewed the draft NAGCAT guidelines to clarify and correct the content [Lee and Marlenga, 1999].

NAGCAT were released in 1999 as both a professional resource manual and as parent resource booklets. The professional resource manual contains a comprehensive description of the findings from the consensus development process, as well as the job hazard analysis and child development checklists for each of the 62 different jobs [Lee and Marlenga, 1999]. Each parent resource booklet is a collection of six to ten guideline posters that are visually appealing and include a job illustration, adult responsibilities, main hazards, safety reminders, a developmental checklist, and recommended supervision. The posters are grouped into booklets based on the job types of animal care, general activities, haying operations, implement operations, manual labor, specialty production, and tractor fundamentals (see www.nagcat.org).

METHODS

A systematic method was employed to accomplish the project objectives (Table II). Biweekly meetings of the project staff were held to monitor progress throughout the project. The methods included a survey of agricultural safety practitioners and researchers regarding the application of NAGCAT, a synthesis of the scientific evidence regarding NAGCAT from the peer-reviewed literature, and an in-person priority setting meeting.

TABLE I. Examples of Professional Activities Involving NAGCAT Resource

Research	<ul style="list-style-type: none"> ● Evaluating dissemination methods ● Evaluating efficacy in preventing injuries ● Validating child development content
Education	<ul style="list-style-type: none"> ● Distributing printed guidelines ● Using resources in an instructive display ● Creating interactive materials based on NAGCAT principles ● Presenting research findings at national and international meetings ● Developing a continuing education course for nurses
Remediation	<ul style="list-style-type: none"> ● Giving to parents as an informational resource
Support	<ul style="list-style-type: none"> ● Providing technical assistance ● Creating and maintaining dedicated Internet web site
Promotion	<ul style="list-style-type: none"> ● Conducting media campaign ● Creating and maintaining dedicated Internet web site
Adaptation	<ul style="list-style-type: none"> ● Creating Swedish resources ● Developing Hmong resources ● Translating guidelines into French

TABLE II. NAGCAT Resource Assessment Method

Assessment goal	Assessment question	Data collection technique
<ul style="list-style-type: none"> Assess the current practical evidence 	<ul style="list-style-type: none"> What are NAGCAT's major strengths? What are NAGCAT's major limitations? What are the barriers for professionals using NAGCAT? What are the barriers for parents using NAGCAT? 	<ul style="list-style-type: none"> Advisors survey In-person meeting
<ul style="list-style-type: none"> Assess the current scientific evidence 	<ul style="list-style-type: none"> What are concerns involving the content/format of NAGCAT? What have we learned about the dissemination of NAGCAT? What are issues regarding implementation of NAGCAT? What is the efficacy of NAGCAT? 	<ul style="list-style-type: none"> Literature synthesis In-person meeting
<ul style="list-style-type: none"> Set priorities 	<ul style="list-style-type: none"> What are the future priorities for NAGCAT? Who should be involved in this effort? 	<ul style="list-style-type: none"> Advisors survey Literature synthesis In-person meeting

Survey

Sample selection

The survey was used to gather both research and programmatic evidence concerning the NAGCAT resource. While some research findings were available in the literature, the authors recognized that there was a gap in the knowledge of practical concerns regarding NAGCAT. Therefore, those selected to complete the survey had a variety of experiences using NAGCAT with diverse farm populations in different regions of the United States and Canada. Individuals representing the following groups were asked to complete the survey: NAGCAT primary advisors from the United States and Canada who participated in the development of NAGCAT, youth-serving agricultural safety organizations, including migrant and internationally focused groups, researchers who have evaluated the NAGCAT resource, the director at each of the nine National Institute for Occupational Safety and Health (NIOSH) regional agricultural safety and health centers, and representatives from NIOSH Child Agricultural Team and United States Department of Agriculture state extension program.

Instrument

The project team developed a nine-item survey instrument. Respondents were asked in an open-ended format to provide their views regarding the strengths and limitations of the NAGCAT resource, barriers to farm safety professionals and parents using NAGCAT, and recommendations regarding the future directions and priorities for the NAGCAT resource.

Procedure

An email message was sent to 33 individuals in December 2004 with a letter explaining the purpose of the survey and

giving instructions for accessing it from our institution's web site. Participants could elect to either email or fax a copy of their responses. Two weeks later, a reminder email message, including the original letter was sent to the individuals who had not initially responded.

Analysis

The survey responses were entered into an AccessTM database to facilitate compilation of the overall results. Using a qualitative content analysis process, the responses were systematically grouped into similar thematic categories [Busch et al., 2005]. A comprehensive list of priorities was developed from the results of the survey.

Scientific Literature

In looking for relevant NAGCAT literature, the following databases were searched: PubMed, Badgerlink, Agricola, Biosis, CAB Abstracts, SciSearch, Federal Research in Progress, and ProQuest using the terms "North American Guidelines for Children's Agricultural Tasks" and "NAGCAT." In addition, we conducted a GoogleTM Internet search and contacted individuals who were working closely with NAGCAT to identify supplementary literature. The literature was summarized and key points were identified to assist in the priority-setting process.

In-Person Meeting

Each survey respondent was invited to the in-person priority setting meeting. Four individuals who were unable to attend were asked to provide written feedback regarding the priorities. Their responses were incorporated into the priority setting process. The meeting took place over 2 days during March 2005. The specific meeting objectives were to identify priorities for the NAGCAT resource, and select two to three

priorities for NAGCAT that should be the responsibility of the NIOSH-funded National Children's Center that provides national leadership in childhood agricultural injury prevention.

Two weeks prior to the meeting a pre-reading packet, including a priority list developed from the survey results and a NAGCAT literature synthesis, was sent to meeting attendees (hereafter referred to as advisors) and those survey respondents who were unable to attend. The priority list was also used as the starting point for discussion at the in-person meeting. The findings of the scientific literature synthesis and the advisor's survey were incorporated into a "Current State of NAGCAT" presentation given at the beginning of the in-person meeting to help inform the decision-making process and assist advisors in addressing the meeting objectives. Prior to the start of the meeting, each advisor was asked to identify and rank their top five priorities from the list sent out in the pre-reading packet. The results were posted on a NAGCAT priority decision matrix [Gallagher and Rooney, 1999].

Once the initial phase of the meeting was completed, advisors discussed criteria to use in the decision-making process and then eliminated, clarified, revised, and eventually ranked the remaining priorities using a nominal group process technique [Nicholas et al., 2001; US Department of Health and Human Services, 2005]. After ranking the overall NAGCAT priorities, the advisors recommended which of the priorities identified should be the responsibility of the National Children's Center.

Two weeks after the meeting, a summary of the results was sent to all the advisors, as well as those survey respondents who were unable to attend. Each advisor was asked to provide feedback regarding whether the summary accurately depicted the meeting outcomes.

RESULTS

Survey

A total of 19 of 33 surveys were returned for a 58% overall response rate. Six broad priority areas were identified by the respondents: conduct further research to evaluate and support NAGCAT, develop NAGCAT for new populations, address barriers that prevent implementation of the NAGCAT, revise the content and format of the NAGCAT resource, create a dissemination and marketing strategy for NAGCAT, and pursue additional strategies to prevent pediatric agricultural injuries. Within each broad category, survey respondents' specific priority recommendations were noted and a final list of 13 priorities was developed (Table III).

Scientific Literature Synthesis

The literature synthesis was not intended to be a systematic review, but rather an overview of the literature addressing the efficacy and utilization of NAGCAT [see

TABLE III. NAGCAT Priority List From Advisors' Survey Results

Conduct research to evaluate and support NAGCAT
• Evaluate the effectiveness of NAGCAT
• Gather evidence to further validate the content of NAGCAT
Create NAGCAT for new populations
• Develop guidelines for different populations
Revise NAGCAT implementation strategy
• Assess/address users' perceptions regarding NAGCAT
• Consider users' barriers to applying NAGCAT
• Increase awareness of NAGCAT among potential users
• Provide training and support for NAGCAT users
Improve NAGCAT dissemination efforts
• Increase availability/accessibility of the guidelines
• Develop dissemination/marketing plan for NAGCAT
Consider related strategies to prevent injuries
• Address supplementary, linked approaches for agricultural injury prevention
Rework NAGCAT content and format
• Add new guidelines
• Reduce the number/length of the guidelines/categories
• Change the format/content of the guidelines

Hartling et al., 2004 for a systematic review of interventions (including NAGCAT) to prevent pediatric farm injuries].

The literature search identified 12 manuscripts specifically addressing NAGCAT. All have been published since 2001. The themes of the articles were varied and addressed the following general topics: appraising the efficacy of NAGCAT to prevent injuries (one retrospective case series study and one randomized control trial), determining the appropriate target population for NAGCAT (two descriptive studies), assessing factors that affect implementation of NAGCAT (eight descriptive studies), addressing issues regarding the content and/or format of NAGCAT (three descriptive studies and one retrospective case series study), and evaluating the efficacy of NAGCAT dissemination strategies (one descriptive study and two randomized control trials). One manuscript systematically reviewed childhood agricultural injury prevention interventions, including NAGCAT. Table IV shows each manuscript by author, study design, objectives, and the theme(s) that were addressed. The themes are summarized in the following paragraphs.

Efficacy of NAGCAT

The two studies assessing the efficacy of NAGCAT showed that for the population that they cover, working children between 7 and 16 years of age, NAGCAT could potentially prevent many serious injuries. In both these studies, however, it is important to note that although NAGCAT demonstrated efficacy in preventing injuries among working children, NAGCAT often did not apply because in the majority of cases children were either under 7 years of age or not working at the time of the injury [Marlenga et al., 2004; Gadomski et al., 2006].

TABLE IV. Studies Included in NAGCAT Resource Literature Review and Synthesis

Study	Design	Objectives	Theme(s)
Cohen [2002]	Descriptive	To assess whether NAGCAT are consistent with federal and certain state regulations for agricultural work by youth outside of the parent/child relationship of assigning tasks on the family farm	<ul style="list-style-type: none"> • Target population • Content
Gadomski et al. [2006]	RCT*	To evaluate the effects of active dissemination of NAGCAT on the incidence of childhood agricultural injuries on farms in upstate New York	<ul style="list-style-type: none"> • Efficacy • Dissemination • Implementation
Hartling et al. [2004]	Review	To synthesize the current evidence on the effectiveness of interventions to prevent childhood agricultural injuries	<ul style="list-style-type: none"> • Review
Marlenga et al. [2001]	Descriptive	To identify which tractor jobs children are assign to and compare the assignments with NAGCAT recommendations regarding assigning tractor work to children	<ul style="list-style-type: none"> • Implementation
Marlenga et al. [2002]	RCT*	To compare the efficacy of a standard dissemination strategy to an enhanced, multi-phased dissemination method in influencing parents to use and/or apply NAGCAT when assigning farm tasks to their children	<ul style="list-style-type: none"> • Dissemination • Implementation
Marlenga et al. [2004]	Case Series	To evaluate the potential for NAGCAT to prevent injuries by systematically applying NAGCAT to case series descriptions of fatal, hospitalized, and restricted activity injuries experienced by children on farms in the United States and Canada	<ul style="list-style-type: none"> • Efficacy • Content
Mason and Earle-Richardson [2002]	Descriptive	To describe patterns of childhood agricultural injury and assess the extent to which inappropriate age/developmental stage may contribute to these injuries	<ul style="list-style-type: none"> • Implementation • Child development
Neufeld and Cinnamon [2004]	Descriptive	To examine farm parents' attitudes toward farm safety professionals using qualitative and quantitative data gathered from a study evaluating NAGCAT	<ul style="list-style-type: none"> • Implementation (users' perceptions)
Pickett et al. [2003]	Descriptive	To assess the child development knowledge of parents that received NAGCAT and determine whether knowledge was associated with parents use of NAGCAT in assigning tractor jobs	<ul style="list-style-type: none"> • Implementation (child development)
Rasmussen et al. [2003]	Descriptive	To synthesize the available research on Hmong agricultural practices, child development of Hmong children in an injury prevention context, and the potential for adaptation of NAGCAT for Hmong children in the United States	<ul style="list-style-type: none"> • Target population • Implementation • Content
Zentner et al. [2005]	Descriptive	To describe parents' perceptions of risks on their farms and assess whether their perceived risks are associated with use of NAGCAT	<ul style="list-style-type: none"> • Implementation (users' perceptions)
Zentner and Marlenga [2002]	Descriptive	To determine whether simply mailing the NAGCAT parent collection to a non-volunteer sample of farm parents influenced them to use NAGCAT when assigning farm work to their children	<ul style="list-style-type: none"> • Dissemination • Implementation (users' perceptions) • Content

*Randomized controlled trial.

Population not covered by NAGCAT

Several studies including those mentioned above show that young children under 7 years of age and non-working children were at the greatest risk of injury. However, NAGCAT are not currently designed to address these groups [Hartling et al., 2004; Marlenga et al., 2004; Gadowski et al., 2006]. Other populations identified in the NAGCAT literature include hired working children and the Hmong population living in the United States. In both these situations, the authors concluded that NAGCAT are not appropriate for these groups in their current form [Cohen, 2002; Rasmussen et al., 2003].

Implementation of NAGCAT

Much of the research (eight studies) examined how child development issues, parents' assignment of farm work, farm parents' risk perceptions, and farm parents' attitudes toward safety professionals impact NAGCAT implementation.

In terms of child development and how parents assign farm work, one study concluded that approximately one-third of injuries among a group of New York farm youth were likely to have been influenced by physical, cognitive, and emotional development issues [Mason and Earle-Richardson, 2002]. Further, some farm parents who demonstrated high knowledge of child development still assigned inappropriate tractor work to their children [Marlenga et al., 2001].

Farm parents' perceptions of risk as well as their attitudes toward farm safety professionals also affected how NAGCAT were implemented. Despite perceiving their children to be at high risk for injury, researchers found that slightly fewer than half of those farm parents were actively using NAGCAT [Zentner et al., 2005]. Almost two-thirds of the parents surveyed in another evaluation reported negative attitudes toward farm safety professionals who developed NAGCAT [Neufeld and Cinnamon, 2004].

Content and/or format of NAGCAT

As mentioned previously, the NAGCAT content are not appropriate for certain populations [Cohen, 2002; Rasmussen et al., 2003]. In addition, other research suggests that NAGCAT may be too lengthy as many farm parents stated that it takes too much time to read and use [Zentner and Marlenga, 2002]. Other investigators provided recommendations for changing NAGCAT content and format based upon their findings. For example, the authors of one study report that 10 of the 62 guidelines accounted for almost two-thirds of the observed injury cases, pointing to the creation of a smaller core set of guidelines as a potentially effective revision [Marlenga et al., 2004].

Dissemination of NAGCAT

Two of the three studies looking at strategies for disseminating NAGCAT compared enhanced dissemination methods (farm visit [Gadowski et al., 2006], video, personalized child development information, supportive telephone calls [Marlenga et al., 2002]) with standard, less intensive strategies. Among those families receiving the enhanced dissemination method, there was either an increase in the number of farm parents using NAGCAT or the incidence of farm injuries among children decreased [Marlenga et al., 2002; Gadowski et al., 2006]. On the other hand, another study demonstrated that simply mailing NAGCAT to farm parents resulted in approximately 25% of the recipients reporting that they used NAGCAT when assigning farm work to their children [Zentner and Marlenga, 2002].

Review of pediatric agricultural injury prevention interventions

The systematic review of interventions to prevent pediatric farm injuries noted that NAGCAT demonstrate efficacy, but emphasized that there are few evaluations of interventions aimed at preventing injuries among the population at greatest risk, toddlers, and preschoolers [Hartling et al., 2004]. Several studies recommend, in addition to NAGCAT, minimizing children's exposure to hazardous environments, re-examining the voluntary approach to safety standards, and expanding the array of injury prevention strategies beyond educational methods in order to more effectively address the problem [Marlenga et al., 2001; Pickett et al., 2003; Hartling et al., 2004; Gadowski et al., 2006].

In-Person Priority-Setting Meeting

Twelve advisors from the United States and Canada participated at the in-person priority-setting meeting. The advisors agreed at the start of the meeting that empirical evidence would be the main criteria upon which to guide the discussion and ranking of priorities.

The results of the initial ranking of priorities showed that the following three topics were judged as high priorities: children younger than 7 years of age and non-working children, public policy, and hazard reduction. The advisors decided however, that since these concerns were not specifically related to the NAGCAT resource, they would not be considered at this meeting. Therefore, when the priorities were narrowed, redefined, and eventually ranked, these important issues were left for future consideration in a different setting.

The advisors selected five priorities for NAGCAT to be accomplished in the next 5 years (Fig. 1). Many advisors felt that until the NAGCAT team *considers users' perceptions regarding the guidelines and barriers to using them*, little

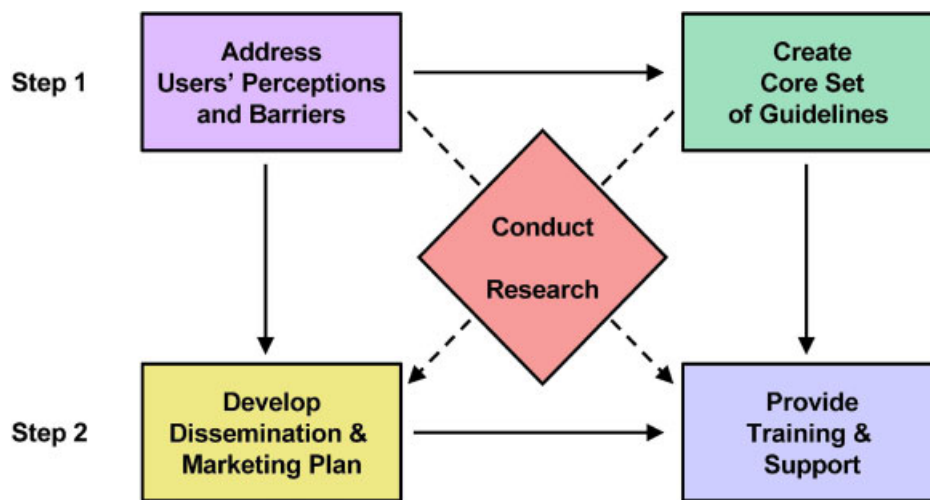


FIGURE 1. North American Guidelines for Children's Agricultural Tasks: Priority Decision Matrix.

progress will be made in motivating parents and farm safety professionals to apply NAGCAT. Based upon research results, the advisors recommended *creation of a revised and reformatted core set of the guidelines*. The *development of a strategic NAGCAT dissemination and marketing plan* was also identified as a high priority. In addition, many of the advisors pointed to *providing training and support for farm safety professionals and parents* as another main concern. Lastly, it was agreed that there is a need to *conduct additional research to facilitate accomplishing and evaluating the priorities*. Each advisor then described how his/her organization could be involved in accomplishing the identified priorities.

The advisors were asked to identify two or three priorities for NAGCAT that the National Children's Center should be responsible for implementing. The advisors recommended that the National Children's Center take the lead role in creating a core set of the NAGCAT guidelines and developing NAGCAT lesson plans for trainers and supporting NAGCAT materials for users. Additionally, the National Children's Center should coordinate the NAGCAT.org Internet web site as a central source of information and resources for dissemination as well as support for users.

DISCUSSION

Synopsis of Main Findings

Injuries involving children engaged in farm work are an important component of the pediatric agricultural injury problem. In the absence of work standards for farm youth, NAGCAT can serve as an important injury prevention resource. Within this context, we were able to set priorities using empirical evidence to guide future research and practice involving the NAGCAT resource.

While NAGCAT have the potential to prevent the most serious work-related injuries experienced by children in the correct age range (7–16 years of age), the majority of pediatric agricultural injuries occur to non-working children and children younger than 7 years of age. Thus, strategies must be developed that build upon, yet also go beyond NAGCAT, to target the leading causes of pediatric farm injury.

Strengths and Limitations

This project employed a multi-method approach to set priorities for an important injury prevention resource and involved advisors from both the United States and Canada. Priorities for NAGCAT in the next 5 years were identified.

There are several limitations to this project that must be considered. Although the authors tried to be inclusive of the major activities that could provide scientific and programmatic evidence to inform priority setting, it was not possible to identify *all* NAGCAT-related activities taking place throughout the United States and Canada. In addition, despite the fact that a diverse range of individuals and groups were represented in the survey process, others who were not asked to participate might have provided different views regarding NAGCAT. Further, the survey non-responders may have had insights and priorities to share that were not identified in our process.

Next Steps

A coordinated North American effort will be necessary in order to move forward to achieve the newly identified NAGCAT priorities. Practitioners, researchers, agribusinesses, and farm safety and youth-serving organizations will need to work collaboratively with the National Children's

Center in order to carry out the identified priorities. NIOSH will have a key role to play to ensure that funding through the Child Agricultural Initiative [Castillo et al., 1998] is directed to the translation of NAGCAT research into practice through the five priorities identified, and to evaluate the outcome of those priorities.

CONCLUSION

This assessment and priority setting process was successful in setting measurable and potentially achievable goals for the NAGCAT resource. A systematic method and the use of evidence-based knowledge regarding NAGCAT were employed in accomplishing the project objectives. An informed group of advisors identified five main priorities for the next 5 years. As we move towards 2010, those involved in pediatric agricultural injury prevention will have a blueprint to ensure that NAGCAT are an effective and widely used resource to prevent work-related injuries. Beyond NAGCAT, there is an urgent need to develop new prevention initiatives to address non-working children who suffer the majority of serious injuries on North American farms.

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