

# State of the Art in Young Worker Safety Interventions in the United States

*Susan S. Gallagher, MPH, Tufts University*

*Sara Rattigan, MS, Massachusetts Department of Public Health*

## **Introduction**

Most youth in the United States have been employed by the time they reach the age of high school graduation [CHSICL, 1998]. It has been suggested that working affects both the academic achievement and the social development of youth. There is also a wealth of data suggesting that young workers have a high rate of injury on the job and are inadequately protected from occupational injury [CHSICL 1998; Runyan and Zakocs 2000; Suruda et al. 2003; Mardis and Pratt 2003]. Many of the research articles that provide a descriptive epidemiology of injury to teen workers also offer recommendations for prevention. The National Occupational Research Agenda (NORA) Intervention Effectiveness Team emphasized that development, implementation and evaluation of effectiveness are central elements to preventing work-related injury and illness [Goldenhar et al. 2001]. Yet not a lot is known about what interventions have been implemented and/or evaluated for this population.

As requested for the Symposium on Young Worker Health and Safety Interventions and Knowledge Mobilization Strategies, this paper examines past interventions to protect working youth in the U.S. It aims to:

- 1) Review existing program and policy interventions designed to improve safety for young workers by type, scope, target audience and approach (e.g., education, engineering, enforcement);
- 2) Identify gaps in the knowledge base on effective interventions for improving young worker safety;
- 3) Identify challenges to and recommendations for improving the evidence supporting young worker safety program and policy interventions; and
- 4) Consider strategies for knowledge mobilization about young worker health and safety.

## **Methods**

We surveyed published literature from 1989 through 2008 (20-year period) that referenced interventions related to young worker safety. Young workers were defined as 21-years-old or less. The search was supported by the Tufts University Hirsch Health Sciences Library and was conducted through the OVID and PubMed databases. The following search terms were chosen: adolescent/young worker, safety, occupational safety, industrial safety, injury, injury prevention, agriculture, young/adolescent worker safety education, young/adolescent worker safety

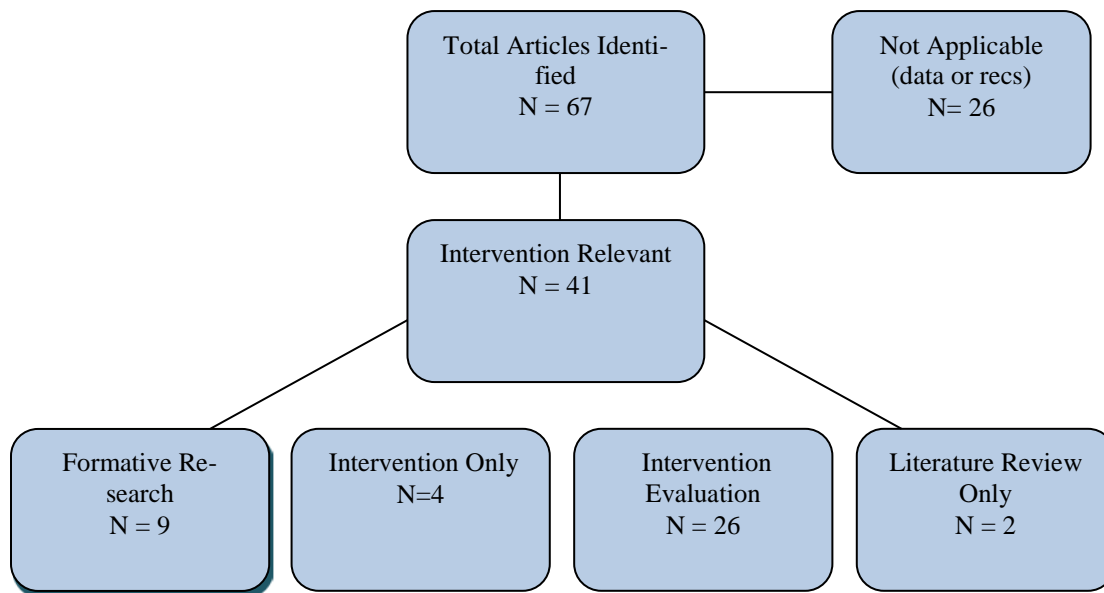
regulation, young/adolescent worker regulation/law enforcement, young/adolescent worker protective equipment, young/adolescent worker labor laws, and young/adolescent farm worker safety.

Websites of federal agencies with some relationship to young workers were also searched. These included: National Institute for Occupational Safety and Health (NIOSH), the U.S. Department of Labor (DOL), and the Division of Adolescent and School Health (DASH) at the Centers for Disease Control and Prevention (CDC).

In addition, an email request was sent out to the Young Worker Safety and Health Network's list serve [YWSHN 1997] and the State and Territorial Injury Prevention Directors Association [STIPDA 1992] *Injury Exchange* (now called the *Safe States Exchange*), an online community designed to facilitate networking, relationship building, and information exchange between all STIPDA members. We hoped to use a snowball technique to identify descriptions of unpublished young worker interventions in the U.S. in any type of setting, or unpublished evaluations of program effectiveness, e.g. program reports. No responses were received from STIPDA and approximately 10 were received through the Young Worker list serve. The latter method resulted in one additional publication.

The search yielded a total of 64 articles initially identified as relevant. We identified three additional articles in reviewing the reference lists of articles found during the search, for a total of 67. Twenty-six of these were deemed not applicable because they reported on general injury occurrences among young workers, or only provided recommendations without any specific intervention reference or description. Articles that were published earlier than 1989, later than 2008, and/or in countries other than the U.S. were omitted as were duplicate articles identified. The remaining 41 articles were sorted according to Figure 1.

**Figure 1. Young worker intervention literature search results.**



Search results were then reviewed and assigned by content into a classification scheme composed of 13 variables. See Appendix Gallagher-I for detailed definitions. Variables included those listed in the white paper solicitation by the symposium principal investigators and others added by the co-authors. They included the following:

- Funder of the research to track sources of support
- Publication year to track trends in intervention development and research
- State where study conducted to assess geographic distribution
- Availability of full text
- Industry setting for the intervention
- Type of intervention (education, engineering, enforcement)
- Scope of the intervention (formative research, intervention, literature review)
- Target audience
- Age range of workers
- Objectives of the study
- Level of the ecological model addressed
- Evidence base, if any, of the research
- Research results, both positive and negative
- Additional notes on the article, including limitations specific to the article or to worker safety interventions overall.

### ***Overview of what is currently being done to protect working youth in the U.S.***

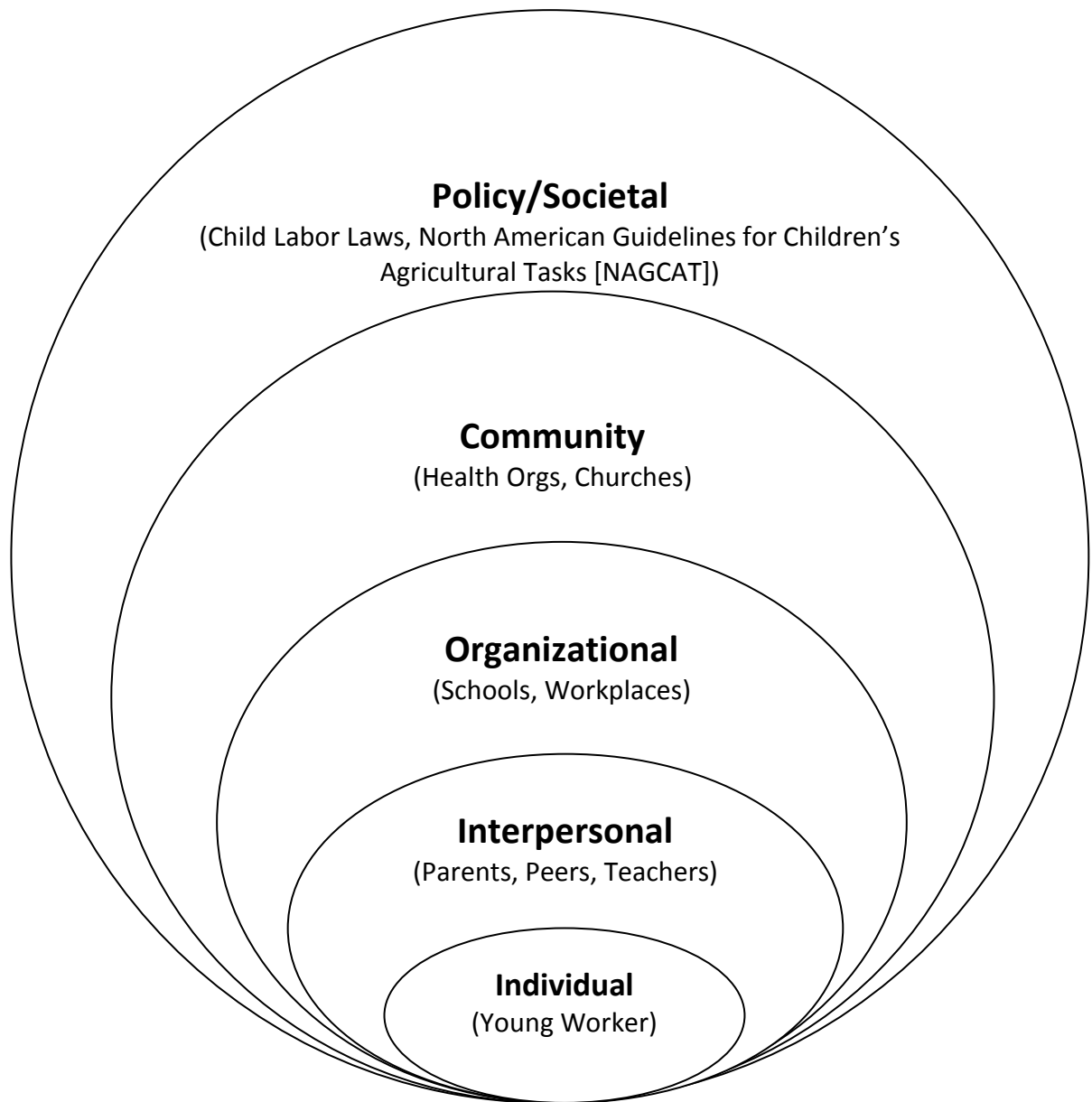
#### **Background - Importance of maintaining diversity of strategies**

It has long been established in the field of injury prevention that it is important to combine efforts and maintain a diversity of strategies to: alter unsafe behaviors; change social norms; convince policy makers to take action through education; make the physical environment and/or consumer products less hazardous through engineering and design changes; and regulate compliance with safety standards through passage of regulations/legislation and enforcement/litigation [Haddon and Baker 1981]. Providing effective protection in the workplace for adolescents, therefore, also requires a mix of these strategies. Some of these include: equipment design and other passive safety features; job-specific safety training by the employer; adequate supervision; matching required job skills with adolescent development; informing parental attitudes about young workers; general training about hazards and risk avoidance in the workplace; and better public information and education about aspects of child labor laws and their enforcement.

Note that we also examined interventions by the five level socio-ecological model, used in public health as a framework to develop interventions and better understand the effects of potential prevention strategies [Sallis and Owen 2002]. This model considers the complex interplay between the individual, interpersonal (family, significant others, peers), organizational, community, and policy levels. The interdependence outlined in this model emphasizes that health improvement or risk reduction is not always about individual behavior per se, but rather individual outcome, through whatever level it can best be achieved.

Effective interventions are often implemented within and across levels to reduce individual and collective health risks [Sallis and Owen 2002; Stokols 1996]. When applied to young worker safety, the socio-ecological model draws attention to areas in need of change other than young worker attitudes and behavior. It provides leverage to show movement toward the long-term goal of young worker behavior change through means of change in other populations or policies first. This approach is more likely to sustain prevention efforts over time than any one-dimensional effort.

**Figure 2. Socio-ecological model [Sallis and Owen 2002].**



Individual level interventions directly target young workers in trying to influence their beliefs about and attitudes toward worker health and safety and injury prevention, as well as promoting positive behavior change. The interpersonal level targets a population with whom young workers interact personally in order to promote positive behavior change in young workers; this could include teachers or site managers, as well as peers and parents. The organizational level speaks to the impact of institutional frameworks on young worker safety, such as schools or places of employment.

Interventions at the community level make use of how community entities interact with each other and the local population to influence health and safety behavior in young workers. This is an important level because the more support one has, the stronger the intervention will be, whether in terms of financial support, policy support, or peer support. An example of community power might be involving local health care providers in educational or policy efforts that keep workers safer on the job, because these efforts in turn will keep their patients healthier overall.

Finally, the public policy level represents the influence and instruction from a societal level on young worker safety. The Occupational Safety & Health Administration [OSHA], the North American Guidelines for Children's Agricultural Tasks [NAGCAT], the Fair Labor Standards Act [FLSA] and many other child labor-related laws and policies are housed within this level. Laws are critical because they are enforceable, which increases the likelihood of positive behavior change by decreasing the benefits of non-compliance.

Prevention strategies should include a continuum of activities that address multiple levels of the model, are developmentally appropriate and are conducted across the lifespan. A visual of this might be a regulation implemented at the policy level that is supported at the community level, enforced at the organizational level, and encouraged at the interpersonal level to lead to safer practices in the workplace, which in turn results in lowered risk to the individual.

Following is a summary of the intervention-related information collected from a review of the 41 relevant articles identified. Young worker ages covered in the intervention literature ranged from eight to 21 years with the majority being teens 14- to 17-years-old or high school age. A few of these studies also included older workers.

### ***Published studies of existing program and policy interventions***

#### **Funders**

NIOSH was the primary funder and provided full or partial funding for 61% of the 41 identified studies. 49% of studies received full funding from NIOSH. In 22% of the studies, the funder could not be determined. The remaining funders included two foundations; two university-based centers (University of North Carolina and University of Texas); a state agency (WA); the National Center for Injury Prevention and Control (NCIPC) at the CDC; the National Institute of Environmental Health Sciences (NIEHS) at the NIH; two Canadian agencies (one governmental); and miscellaneous organizations. Six of the studies cited more than one funder.

#### **Year of Publication**

There has been a steady increase in the number of published intervention studies since 1989 with a maximum number of six identified in each 2005 and 2006. No studies were identi-

fied from 1989 through 1992. There were seven studies published from 1993-1999, 16 from 2000-2004, and 18 from 2005-2008.

**State**

The U.S. states most represented throughout the studies were those in the Western (24%), Midwestern (22%), and Southern (22%) regions of the country. Specifically, California and Iowa independently appeared in five studies each (12%); Kentucky and Mississippi appeared in the same four studies (10%); and North Carolina, Washington and Wisconsin each appeared in three studies (7%). Seven of the studies, or 17%, were conducted in Eastern states.

Of the 41 studies reviewed, 11 (27%) were conducted at a national level and, of those, three included Canadian regions. Not including national papers, only three were multi-state studies. The state was not able to be identified in two studies (approximately 5%).

**Industry**

Agriculture was the primary industry cited for the intervention studies, comprising 51% of the work settings. Five percent each involved the construction industry and the retail and service sectors. The remaining 39% were not specific to any particular industry setting.

**Target Audience**

Within the 41 studies a variety of target audiences were identified, and 10 studies involved more than one target audience (Table 1). The majority of interventions targeted youth directly (54%), followed by teachers (17%) and parents (12%). Six of the studies focused specifically on Latino youth, either working youth (4) or students (2). Community organizations, employers, health care providers and policy makers were least often mentioned as targets.

**Table 1. Target audience for the intervention by sector.**

Target Audience	Agriculture Studies (n = 21)	Non-agriculture Studies (n = 20)	Total Studies (n = 41)
Students/working youth	12	10	22
Teachers/instructors	3	4	7
Parents/family members	4	1	5
Employers	2	2	4
Health care providers	2	1	3
Schools	1	2	3
Community organizations	2	1	3
Policy makers/stakeholders	1	2	3
No specific audience	2	4	6

**Type of Approach – Education, Enforcement, or Engineering**

Education was the primary approach used in the intervention studies. When used in isolation, it accounted for 44% of the intervention studies; in combination with enforcement, education was employed in 63% of the studies. Enforcement was the sole approach in 21% of the in-

intervention studies, and when used in combination with education accounted for 41%. Education and enforcement were the only two approaches used together in combination and accounted for eight studies (20%). Engineering was used as the approach in only two (5%) studies, and three studies were not able to be categorized by approach because the focus was a literature review or perceptual study.

**Table 2. Intervention approach by socio-ecological level.**

Socio-Ecological Level	Single Level (n = 26)	Multiple Levels (n = 13)	Total (n = 39)
Individual	5	4	9
Interpersonal	2	4	6
Organizational	5	5	10
Community	6	3	9
Policy	8	4	12

\* Note: Two literature review studies were not included in the socio-ecological model analysis.

### Type of Approach – Socio-Ecological Level

The majority of the studies (63%) employed a single level of the socio-ecological model (Table 2). Studies that employed more than one level accounted for 32%, with the majority of those involving two levels. Overall, policy dominated as the most included approach within the socio-ecological model, while the interpersonal level (e.g. parents, teachers, peers) was least often the area of focus.

### Scope of Interventions

Twenty-six studies (63%) were classified as evaluations of interventions, policies or programs. Formative research to develop or improve interventions, policies or programs was the primary focus of nine studies (22%) that did not include an intervention component. Four studies were identified as descriptions of existing interventions, policies or programs without any evaluation, and two studies were literature reviews of current interventions, policies or programs.

### Objective of the Study

Just over half (54%) of the studies had a single objective. These were best classified, in order of frequency, as knowledge change (5), policy change (5), organizational change (3), injury change (prevention/reduction) (3), attitude change (2), curriculum change (2), and behavior change (1). Studies with more than one objective (39%) usually involved a combination of knowledge, attitude and/or behavior change. Taking into account both single and multi-objective studies, knowledge change still dominated (10), followed by attitude change (9), policy change (8), organizational change (8), behavior change (6) and curriculum change (3). Four studies [Banco, et al, 1997; Gadomski, et al, 2006; Marlenga et al., 2006; Zierold and Anderson, 2006] specifically stated injury change as a *measurable* objective, three of which were combined with policy change (2) and behavior change (1).

### Study Design - Evidence Base

The largest category of study design was the cross sectional survey with 15 articles or 37% of all the identified studies. Some of the studies also included a second method, focus groups. Quasi-experimental design was the method used in 10 studies (24%), followed by four randomized control trials (RCTs) (10%), four retrospective case series (10%), an observation study, and a focus group study. Six studies were purely descriptive and included literature reviews or trend reports.

### Evidence of Effectiveness

A number of young worker safety interventions showed promising evidence-based results, which should be noted as building blocks for future intervention development or existing intervention improvement. These 12 studies are summarized in Table 3 by their objective and represent 17 areas where positive change was in evidence.

**Table 3. Interventions with some evidence of effectiveness.**

Objective	Target Audience	Industry	Design	Author
<b>INJURY REDUCTION</b>				
NAGCAT	Youth	Agriculture	RCT	Gadomski . 2006
Box cutters	Youth	Retail	RCT	Banco et al. 1997
<b>BEHAVIOR CHANGE</b>				
NAGCAT	Parents	Agriculture	RCT	Marlenga et al. 2002
NAGCAT	Parents	Agriculture	Observation	Zentner et al. 2005
AgDARE <sup>1</sup>	Youth	Agriculture	Quasi Experiment	Reed and Kidd 2004
AgDARE	Youth	Agriculture	Quasi Experiment	Reed et al. 2003
Work Permits	Youth	All	Observation	Delp et al. 2002
<b>ORG CHANGE</b>				
Box cutters	Supermarkets	Retail	RCT	Banco et al. 1997
<b>POLICY CHANGE</b>				
NAGCAT	Farm Managers	Agriculture	RCT	Gadomski et al. 2006
Worker Permits	Youth	All	Observation	Delp et al. 2002
Worker Permits	Youth	All	Observation	Zierold and Anderson 2006
<b>KNOWLEDGE</b>				
Farm Safety Day Camps	Youth	Agriculture	Quasi Experiment	McCallum et al. 2005
English as a 2 <sup>nd</sup> Language Curriculum (ESL)	Latino Youth	Agriculture	Quasi Experiment	Teran et al. 2008

<sup>1</sup> Agriculture Disability Awareness and Risk Education.

Youth @ Work: Talking Safety	Youth	All	Quasi Experiment	Bush and Miara 2008
ATTITUDES				
AgDARE	Youth	Agriculture	Quasi Experiment	Reed et al. 2001
AgDARE	Youth	Agriculture	Quasi Experiment	Reed and Kidd 2004
ESL Curriculum	Youth	Agriculture	Quasi Experiment	Teran et al. 2008

### **Injury reduction**

Two RCTs showed positive change in preventing injuries among young workers. In the first, farms in which lay educators visited and reviewed the North American Guidelines for Children's Agricultural Tasks (NAGCAT) had a longer time to occurrence of a NAGCAT-preventable injury among young workers, in comparison to farms that had no review of the guidelines [Gadomski et al. 2006]. The second showed that supermarkets providing protective safety cutters for employee use had far fewer employee injuries, when compared to control and experimental groups, both using regular case cutters and one exposed to safety training [Banco et al. 1997]. The Banco study also found that intervention supermarkets saved a significant amount of money as a result of fewer employee injuries, an incentive for wider organizational implementation of the protective cutters.

### **Behavior change**

Five interventions showed a positive change in behavior. Two of these targeted parent behavior through dissemination of NAGCAT. In one case parents who received tailored delivery of NAGCAT were more likely (50%) to be using the guidelines 15 months later than a control group [Marlenga et al. 2002]; and in another case, 90% of parents who had been exposed to NAGCAT reported having made one or more NAGCAT-recommended changes on their farm (although most were in how a job was done, and not a purchase of protective equipment). Two of the three behavior-change promising interventions resulted from the AgDARE program, a school-based agricultural safety curriculum, developed by two public health nurses: the first showed an increase in protective behaviors among an intervention group of students, observed for performance of certain tasks seven to fourteen months after training [Reed et al. 2003], however not in as many areas as desired. In another evaluation in which AgDARE and non-AgDARE students were visited between 11 and 20 months after intervention, 76% of those visited showed one or more positive safety behavior changes in performing farm tasks since participating in the program; those visited were also more likely than the control group to engage in safety behaviors not covered by the AgDARE curriculum [Reed and Kidd 2004]. The final behavior-change intervention was based at the policy level, and found through survey results that students without work permits were more likely to perform hazardous tasks than those with permits [Delp et al. 2002].

### **Policy change**

Three interventions showed positive effects of policy. The first was in the Gadomski study [Gadomski et al. 2006] in which farms receiving NAGCAT materials were less likely to violate certain age-minimum NAGCAT recommendations than control farms. Two different survey-

based studies found that young workers without permits were less likely to receive safety training than those with permits [Delp et al. 2002; Zierold and Anderson 2006].

### **Knowledge and attitude change**

Six occurrences—three each—of knowledge and attitude changes were also shown across multiple interventions. The AgDARE program, which involves nurse participation in addition to school teacher instruction, has shown twice in controlled studies that it can significantly increase positive attitudes among students toward farm safety, including their perceived ability to prevent farm injury [Reed et al. 2001; Reed and Kidd 2004]. The other intervention showing significant attitude change was a high school-based English as a Second Language (ESL) curriculum addressing agricultural safety, for predominately Spanish-speaking students, in which a non-equivalent comparison group was used as a control [Teran et al. 2008]. The attitudes of the ESL participants improved regarding their ability to protect themselves, and their perceptions of the dangers of pesticide exposure. The Teran study also found that ESL participants showed greater knowledge about laws and hazards, as well as solutions and resources for problem reporting, than students not exposed to the curriculum. It should also be noted that there was great enthusiasm for the ESL curriculum from the whole community.

The other two increases in knowledge occurred in another high school-based educational program and a safety day camp for younger children (8 to 13 years old). The Farm Safety Day Camps found, through pre-tests and post-telephone interviews, an increase in knowledge and decrease in risk behaviors (based on knowledge) among youth [McCallum et al. 2005]. The Youth @ Work: Talking Safety program, which addresses general worker safety and injury prevention, is a formative research-based, pre-tested curriculum that showed an increase in knowledge about hazard control, young worker rights, and emergency preparedness, based on pre- and post-tests [Bush and Miara 2008].

### **Agriculture vs. Other Industries**

Of all 17 incidences of positive changes resulting from interventions, 11 (attributed to eight studies), or nearly 65%, are within the agriculture setting. Only six (attributed to a total of four studies) represent other industries, and of these only two incidences within one study (box cutter) targets a specific non-agricultural industry.

### **Study Design**

Of the 17 incidences of positive change, only 29% (representing 3 studies) were determined through RCTs, the strongest and preferred study design. The majority (47%) resulted through quasi-experimental designs (six studies total), still worthy of note, and the fewest (24%) through observational studies (3 studies total), the least preferred method for reliability.

### ***Evidence of Ineffectiveness***

In addition to the evidence of effective interventions, several studies showed poor outcomes. These should also be considered for future intervention development and are summarized below in Table 4.

**Table 4. Interventions with limited or no evidence of effectiveness.**

Objective	Target Audience	Industry	Design	Author
<b>INJURY REDUCTION</b>				
Act 455 (WI)	Youth	Agriculture	Retro Case Series	Marlenga et al. 2006
Worker Permits	Youth	All	Observation	Zierold and Anderson 2006
<b>KNOWLEDGE</b>				
Partners Program	Youth	Agriculture	RCT	Lee et al. 2004
<b>ATTITUDES</b>				
NAGCAT	Parents	Agriculture	Observation	Zentner et al. 2005
Partners Program	Youth	Agriculture	RCT	Lee et al. 2004

### **Lack of injury reduction**

Two interventions that aimed to show a reduction in young worker injuries did not. The first, related to the relationship of worker permit and young worker performance, is of particular interest: despite two studies demonstrating that young workers with permits are more likely to receive safety training [Delp et al. 2002; Zierold and Anderson 2006], the Zierold study also found that among the same group of workers, those with permits were just as likely as those without to be injured on job or experience near misses. Another injury prevention initiative involved implementation of a law (Act 455 in Wisconsin) that required tractor drivers under age 16 to complete a certification course [Marlenga et al. 2006]. Unfortunately, there was no significant change in tractor crashes among youth or when youth were considered at fault, or occurring on public highways, post Act 455. The lack in injury reduction was attributed to: an incomplete certification curriculum, a lack of attention to increasing the number of tractors equipped with ROPS, and a lack of enforcement of the Act, suggesting a policy alone is not enough to significantly reduce tractor-related crashes.

### **Lack of knowledge and attitude change**

The other less than desirable outcomes occurred in the areas of knowledge and attitude. One nationally implemented rural youth health and safety initiative, called the Partners Program, designed to promote positive student attitudes, by building leadership skills and sustainable community partnerships, failed to affect safety knowledge or attitudes, leadership, or self-concept and self-reported injuries among young farm workers, either short- or long-term when compared to control groups [Lee et al. 2004]. The evaluation team noted two contributors to the lack of significant results: lack of any testing of adapted curriculum materials, and inconsistent implementation among intervention groups, again emphasizing the importance of formative research and pretesting that likely contributed to the positive knowledge results of Youth @ Work: Talking Safety [Bush and Miara 2008]. The other study noting poor attitude outcome occurred in the same study that showed positive behavior change among parents that were actively exposed to NAGCAT; but in terms of attitude, parent perceptions of general farm hazards did not translate into the perception that their children were at high risk for injuries [Zentner et

al. 2005]. While this is not a desirable outcome, it does draw attention to the fact that behavior change may be possible without attitude change.

### **Agriculture vs. Other Industries**

Of all five incidences of evidence noting unsuccessful efforts, four (attributed to three studies), or 80%, are based in agriculture. Only one incident is related to all industries, and none target a specific industry outside of agriculture.

### **Study Design**

Of the five incidences with negative intervention-related findings, two (40%) were from studies using an RCT design (representing one study) and another two used an observational design (representing two studies). The fifth was based on a retrospective case series design, and none were quasi experimental, largely differing from the positive change incidence results.

### ***Moving forward: Current gaps and challenges to address***

#### **Gaps in the knowledge base on effective interventions**

There is a large disconnect between the body of available data on work-related injuries and risk factors for youth workers, and the application of the data for safety interventions.

With the exception of agriculture, there is a notable absence of interventions that address the industry sectors in which youth are employed.

Most interventions target students or working youth at the individual level of the socio-ecological model. Interventions that specifically target other audiences in a position to support safety among working youth, such as parents, health care providers, schools, employers and community organizations, are minimal.

Diverse populations of youth (e.g. non-English speaking, Latino workers, etc.) are growing in the U.S. [US Census Bureau 2010 and 2011], but there are few youth worker interventions that specifically address these populations.

Despite intervention approaches being distributed among the different levels of the socio-ecological model, many of these focus on a single level instead of building momentum across levels, which limits effectiveness.

With the exception of two studies [Kidd et al. 2003; Salazar MK et al. 2004], theory is not incorporated into the design of the young worker interventions. Health communication and health behavior theory should be employed in designing targeted interventions, especially those with the goal of individual knowledge, attitude or behavior change. See Appendix Gallagher-II for an example of one theory, the Transtheoretical Model/Stages of Change.

Engineering/technological solutions for identified problems and adjustment in equipment use and job design to better meet the needs of young workers appear to be limited in the literature

Enforcement of policies and regulations is seldom the subject of studies related to policy intervention.

Studies are not in evidence that aim to motivate young workers to be receptive to the use of protective equipment or other simple preventive measures that help to eliminate hazards. For example, young workers resist wearing seat belts in tractors equipped with ROPS, do not avoid

excessively noisy equipment when wearing ear plugs, and do not avoid dust conditions when wearing masks [Reed, Westneat and Kidd, 2003], due to a false sense of protectiveness.

Employers have been identified as a key contributor to the safety of young workers, either through providing training and protective equipment, or implementing and enforcing guidelines aimed at reducing injuries on the job. There is a lack of interventions that target employers as a means to positive change in young worker safety.

Formative research prior to/in conjunction with the implementation of intervention research is lacking.

There are very few studies with injury reduction set as a measurable objective. Knowledge, attitude, policy and behavior change are the goals of most interventions. Additionally, studies seldom evaluate the translation of knowledge and attitude changes into behavior change.

RCTs and quasi-experimental studies comprise less than one-third of the study designs.

### **Challenges and recommendations in improving the intervention evidence base**

- Expand the resources to conduct intervention studies of high quality. Cultivate relationships with new funders and obtain more funding from non-NIOSH sources
- Move beyond interventions for youth in agricultural settings to other industries in which many youth are also employed (e.g. retail and service).
- In addition to targeting individual youth, encompass other levels of the socio-ecological model as the audiences.
- In addition to educational approaches, propose a mix of strategies within requests for proposals.
- Use existing data to develop, implement and evaluate interventions. Paucity of data on the circumstances for nonfatal and fatal injury is not the reason for the current state of affairs.
- Work to bring employers on board. Reaching employers continues to be a challenge, but identifying the most effective way of communicating with them, either through more targeted messaging or incentive offerings, is critical to the improvement of young worker safety across the country.
- Change societal norms around young worker safety to support the country's future workforce and overall health. Begin assessing how to transform societal views around recognizing young workers as having a right to and deserving safer working environments and adequate training. A large part of this is improving how to build a political will.
- Widely apply and put into practice more evidence-based interventions. Although knowledge to implement evidence-based strategies exists, the popular and political will to do so has not been marshaled. Multiple audiences need to be reached with communication tailored to meet the specific perceptions and needs of each, such as in a marketing campaign.
- Convince those in the field to think outside of the box and partner with other disciplines to design more effective interventions. For example, pairing ergonomic specialists with child development specialists could enhance engineering or environmental changes for youth workers; pairing behavioral scientists or health communication specialists with occupational safety researchers could result in more tailored interventions that are theory-based or include effective two-way communication, as opposed to one-way directional dissemination of information.

- Engage the health care community as a partner. Health and public health agencies need to assume some responsibility for preventing injuries to young workers. They need to be coaxed to the table with labor and education agencies. For example, there could be more emphasis on the prevention of adolescent injuries in school-based clinics and other youth-serving programs overseen by the public health sector. Before this can happen, the health care community needs to understand the extent of the problem and its role in addressing it; labor and education agencies need to include them and understand the unique role they play in reaching disadvantaged populations.
- Use technology more effectively. Particularly among adolescent and young adult populations, it is critical to understand modern technologies and make better use of them in initiatives directly and indirectly involving young people.

### **Conclusion**

Work-related injuries among youth offer a good example of insufficient progress in implementing prevention strategies. The literature has identified many factors and occupational settings that contribute to the high rate of injuries to working youth. It has also identified many recommendations for prevention; yet, attempts to implement and evaluate interventions for young workers have been limited. Most that exist focus on educating youth about hazards in the workplace, often through school curriculum, or focus on youth working in agricultural settings. Adults such as parents, employers and policy makers are in a position to address the safety of youth workers, but are rarely targeted in intervention. The emphasis has remained on educating youth and has not fully encompassed the diversity of strategies that are needed.

Today there are effective prevention measures that have *not* been uniformly applied to improve the safety of young workers; we must weave them in to our existing efforts. Continued progress demands application of theory when designing interventions; an effective balance of education, engineering and enforcement approaches; consideration of the levels of the socio-ecological model as a framework for intervention; and stronger experimental designs. While there will be challenges along the way, that we can clearly identify gaps in young worker interventions to date provides promise that we will have greater success in moving forward.

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# Appendix Gallagher-I: Classification Scheme Variables and Subcategories

Articles were assigned to 13 classification scheme variables in order to identify themes.

1. **Funder:** Entity that provided support for the published research or intervention.
  - Variable (dependent on intervention)
2. **Year:** Year the article was published.
  - Variable (Year range: 1989 to 2008)
3. **State:** The state within the United States in which the study or research was conducted.
  - Variable
4. **Text:** The degree of literature available for review.
  - Full Text
  - Abstract
  - In Press
5. **Work Setting:** The occupational field for which the intervention was developed.
  - Agriculture
  - Construction
  - Retail and Service
  - All
6. **Type:** Which of the three E's the intervention is based in.
  - Education
  - Enforcement
  - Engineering
7. **Scope:** The aim of the intervention.
  - Formative Research: Research necessary to develop or improve effective interventions, policies or programs
  - Intervention: Description of an existing intervention, policy or program
  - Intervention Evaluation: Evaluation of an existing intervention, policy or program
  - Literature Review: A review of current interventions, policies or programs
8. **Target Audience:** The group or entity the intervention was developed to create change in.
  - Young Workers
  - Hispanic/Latino Young Workers
  - Parents
  - Farms

- High Schools
- Child Labor Laws
- Training Programs
- Variable Entities (e.g. supermarkets, community organizations)

**9. Worker Age:** Age of worker behavior for which behavior change/injury reduction is desired.

- 17 and under
- High School
- All
- Variable (specific to intervention)

**10. Objectives:** Goal of intervention or research article.

- Knowledge Change
- Attitude Change
- Behavior Change
- Curriculum Change
- Organizational Change
- Policy Change
- Other (specific to intervention)

**11. Socio-Ecological Level:** Level under which the intervention falls.

- Individual: Targets young worker directly.
- Interpersonal: Targets population with which young worker interacts.
- Organizational: Targets institution that impacts young worker performance.
- Community: Targets groups within the community in which young worker lives/works.
- Policy: Targets policies that have potential to protect or affect young worker safety.

**12. Evidence Base:** Type of design that provides scientific legitimacy to intervention.

- Cross-Sectional Survey
- Controlled Trial
- Observational Study
- Quasi-Experimental Design
- Randomized Controlled Trial
- Retrospective Case Series
- Survey
- Other Variable Design (e.g. focus groups, theory, pre-testing)
- None

**13. Results:** Results of the intervention or research.

- Variable (specific to intervention objectives)

**14. Notes:** Questions and important issues raised based on the intervention or research.

- Variable (specific to the intervention)

## Appendix Gallagher-II: Transtheoretical Model/Stages of Change Theory

The Transtheoretical Model (TM), or Stages of Change theory [Prochaska et al. 2002], seems the most relevant for the development and evaluation of young worker safety and injury prevention interventions [Kidd et al. 2003]. It allows interventions to do more than focus on knowledge and attitude change, and then leap to behavior change. It is comprised of five stages of behavior that lead to continued performance of the desired behavior:

- Pre-contemplation
- Contemplation
- Preparation
- Action
- Maintenance

The beauty of TM is that it can demonstrate movement toward the desired behavior in concrete increments, and fills in the gray area currently lacking between the black and white of knowledge/attitude and behavior. Interventions that use TM become theory based, and also have greater means to show positive results, both of which are important to potential funders.

For example, it may not be effective to model safe protective behaviors for young workers who do not consider themselves at risk for injury: one might first introduce the youth to the idea of workplace safety in order to raise awareness (or knowledge); once they are contemplating worker safety, the next step to move them to *intend* (or prepare) to practice safe work habits might be sharing strategies and benefits; once they have intention and are ready to prepare for safe work practices, modeled behaviors will better resonate and be more effective.

After young workers have moved from pre-contemplation to preparation, they are ready to put what they have learned into action, and once action (or the desired behavior) is demonstrated, it is hoped it will be maintained. However, the model also provides guidance on how to proceed if the target audience falls backward from maintenance: for example, if a group of young workers stop performing a certain behavior, they may need a refresher at the preparation level.

Each stage of change is measurable progress towards achieving behavior change (and can be claimed as such in grant progress reports, etc.).

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**Editors:**

Carol W. Runyan, MPH, PhD

Pediatric Injury Prevention, Education and Research (PIPER) program

Colorado School of Public Health, University of Colorado School of Medicine, and Children's Hospital  
Colorado

John Lewko, PhD

Center for Research in Human Development

Laurentian University

Kimberly Rauscher, MA, ScD

West Virginia University School of Public Health

Dawn Castillo, MPH

Division of Safety Research

National Institute for Occupational Safety and Health

Sara Brandspigel, MPH

Pediatric Injury Prevention, Education and Research (PIPER) program

Colorado School of Public Health, University of Colorado School of Medicine, and Children's Hospital  
Colorado

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