Reaching Teen Farm Workers with Health and Safety Information: An Evaluation of a High School ESL Curriculum

S. Teran, R. Strochlic, D. Bush, R. Baker, J. Meyers

ABSTRACT. *While childhood agricultural injury has long been recognized as an important public health issue, most research has focused on family farms and there have not been many interventions targeting hired youth. This study evaluated the impact of a high school English as a Second Language (ESL) curriculum, designed to provide teen agricultural workers with the knowledge and tools to protect their health and safety in the fields. Using a quasi-experimental design, the research consisted of two intervention groups and a comparison group, and included over 2,000 students from communities that lead California in agricultural production. The research findings revealed that the curriculum had significant impact in terms of increases in knowledge and attitudes, and nearly half of those interviewed after a summer of working in the fields reported implementing new behaviors to protect their health and safety. The curriculum also had extended effects in the broader community, as the majority of students reported sharing the new information with others. The study found that a school-based ESL curriculum is an effective intervention to reach and educate teen farm workers and that ESL classes can serve as a much-needed access point for young farm workers.*

Keywords. *Adolescent worker, Agriculture, ESL curriculum, Farm worker, Latino, Occupational health.*

Children and adolescents working in agriculture face significant health and safety risks and experience work-related injuries and illnesses at a higher rate than youth working in other industries (U.S. DOL, 2003; Villarejo, 2003; Runyan and Zakocs, 2000; Committee on the Health and Safety Implications of Child Labor, 1998; U.S. GAO, 1998; Wilk, 1993). From 1992 to 2000, 42% of all occupational fatalities for youth under age 18 occurred in agriculture (NIOSH, 2003). The National Institute for Occupational Safety and Health estimates that over 8,000 work-related injuries occur annually among youth under 20 years old who work in agriculture (NASS, 2004a).

There is a growing effort to understand the specific hazards and conditions facing hired teen farm workers, as differentiated from children working on their own family's farm, and to implement and evaluate interventions that address the specific needs of this population (S. P. Cooper et al., 2005; S. R. Cooper et al, 2005; Salazar et al., 2004; Bonuato et al., 2003; McCauley et al., 2002; Quandt et al., 2001; Vela Acosta and Lee,

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2001; DeRoo and Rautiainen, 2000; Laracque et al., 1999). Based on the National Agricultural Workers Survey, the Bureau of Labor Statistics estimates that approximately 126,000 teens (ages 14 to 17) work for pay on U.S. farms. Approximately two-thirds (65%) of hired youth are from low-income households, which are also primarily immigrant and Hispanic. Hired teen farm workers are either emancipated (in the U.S. without their families), migrating with their families, or living with their families in one community and working at nearby farms (U.S. DOL, 2000).

To the extent that agricultural health and safety training is available for youth, it is offered in venues that immigrant teen farm workers are unlikely to use: 4-H programs, FFA (formerly Future Farmers of America) meetings, farm safety camps, and school-based vocational education programs (Gadomski et al., 2006; Reed and Kidd, 2002; Carrabba et al., 2000; DeRoo and Rautiainen, 2000; Arroyo and Kurre, 1997). In addition, these programs are often not relevant to hired teen farm workers, who face different hazards than youth working on family farms (Bonauto et al., 2003), may have limited education and English language skills, and have more limited options for addressing problems on the job, often compounded by poverty and unhealthy living conditions (S. R. Cooper et al., 2005; Vela Acosta and Lee, 2001). Some studies have begun to better characterize the needs of this population (S. R. Cooper et al., 2005; Bonauto et al., 2003; McCauley et al., 2002; McCurdy et al., 2002). However, to the best of our knowledge, none have focused on evaluating ways to deliver agricultural health and safety information specifically to this group of youth.

In California, the most productive agricultural state in the country (NASS, 2004b), more than 80% of the state's agricultural work is performed by hired farm labor (Villarejo and Schenker, 2005). Crop workers in California are largely foreign-born (95%), with the overwhelming majority coming from Mexico. Of these, only 7% report speaking or reading English fluently (Aguirre International, 2005).

A pilot study conducted in 1997 identified English as a Second Language (ESL) classes as a potential point of access for reaching hired teens (Arroyo and Kurre, 1997). This survey of ESL classes in four agricultural counties in California found that a significant number of the students worked in agriculture. Evaluating this model to assess its effectiveness could result in the identification of a successful tool that could be implemented in many communities with similar demographics.

The specific aims of the study were to: (1) assess whether students who received information through an ESL curriculum would demonstrate an increase in knowledge and improved attitudes and behaviors regarding injury and illness prevention, as compared to a comparison group; and (2) assess whether a community-based intervention, in the form of workshops on health and safety for parents of students receiving the curriculum, would improve outcomes even further.

Methods

A collaborative that included a university-based health and safety training program, a well-respected community organization, and independent evaluators carried out the study. The study design consisted of a quasi-experimental pre-test/post-test/follow-up nonequivalent comparison group design. The study was carried out in the spring semester during two consecutive years (2001 and 2002) in counties in California's San Joaquin "Central" Valley, a region that leads the state in agricultural production. In each county, schools that were most likely to have large numbers of farmworker families were identified, and outreach and recruitment activities targeted the schools' ESL teachers and principals. Teachers who enrolled in the study represented 22 schools in the intervention

groups and nine schools in the comparison group. There were two intervention groups and one comparison group:

- **School-based intervention group:** In Fresno County, the six-session *Teens Working in Agriculture* curriculum was administered to students by their high school ESL instructors. Each session is 50 minutes long, and is designed to meet the required English language standards for ESL classes, while also providing youth with information and skills that they can use to improve their health and safety in the fields. The curriculum had been developed and pilot tested a few years before this intervention study (Arroyo, 1998). Topics covered include safety procedures in the workplace, health and safety laws and child labor laws that protect teens, hazard identification and solutions, and behavioral actions that teens can take to stay safe at work. Workplace safety protections are understood broadly, and include issues such as access to water and bathrooms, and behaviors such as washing hands before eating and washing work clothes separately. Interactive, "hands-on" activities draw on the teens' own experiences, including role plays, interviews, games, and identifying hazards and solutions through discussion of relevant newspaper articles and pictures of various agricultural work settings.
- **Enriched intervention group:** In Kern and Tulare counties, in addition to providing the curriculum in the ESL classes, there was an effort to educate the students' parents and other family members about health and safety hazards, child labor laws, and ways they could help their children think about and protect their health and safety. This was done through workshops held at each of the schools that participated in the project. Outreach efforts to recruit parents to the workshops were extensive.
- **Comparison group:** This consisted of ESL students from neighboring counties that had similar demographic and economic patterns. These students completed the pre- and post-tests but did not receive the curriculum.

The study design was reviewed by UC Berkeley's Committee for Protection of Human Subjects and was found to satisfy exemption requirements.

Evaluation Methodology

A pre-test/post-test design was used to measure changes in knowledge and attitudes. The pre-test was administered to participating students the week before they received the curriculum, and the post-test was administered within a week of completion of the curriculum. Students in the comparison group completed the pre- and post-tests on a similar schedule: pre-tests were administered at approximately the same time as to students in the intervention groups, and post-tests were administered one to two weeks later. The pre-test was field tested for reliability and validity with a class of 20 ESL students with similar demographics and ESL level. Students were given the option of completing the tests in the language with which they felt most comfortable (English or Spanish). A follow-up telephone survey, administered the following fall, was designed to measure knowledge retention and changes in attitudes and behaviors among students working in agriculture the summer after receiving the curriculum. All students indicating that they had ever worked in the fields, or planned to work in agriculture during the summer following the curriculum, were contacted for inclusion in the follow-up survey.

The evaluation included a qualitative component. Four focus groups were conducted with students who received the curriculum in the spring of 2001 and 2002 to assess their perceptions of the curriculum and its relevance to them as agricultural workers. Two additional focus groups were conducted in the fall of 2002, with students who had worked in the fields the previous summer, to identify knowledge retention and behavior change associated with the curriculum. Telephone interviews were also conducted with a sample

of teachers as well as with a sample of parents who attended the parent workshops and whose children worked in the fields the previous summer.

Data Analysis

Sample calculations required complete pre- and post-tests and follow-up surveys from a minimum of 186 students in each of the intervention groups, as well as from 157 comparison county students (90% power). The sample size was calculated based on California Department of Education data on the targeted counties' Latino student population size, student drop-out rates, and the proportion of Latino students in ESL classes.

The data were analyzed using the Statistical Package for Social Sciences (SPSS). Cross-tabulations were conducted in order to compare differences in outcomes between the intervention and comparison groups at pre-test, post-test, and follow-up. Significant differences between the two groups at each data point are reported at the 0.05 level. Chi-square analyses were conducted to test for differences between expected and actual values among intervention and comparison county respondents. Analysis of variance was conducted to test for differences in means between the two groups.

A General Linear Model (GLM) analysis of variance was used to control for high baseline scores, in order to detect differences even in cases where students scored highly at baseline. The GLM examines several key variables to assess the significance in change between pre-test, post-test, and follow-up scores in the intervention and comparison groups. In the GLM analysis, the post-test score is considered the dependent variable and the pre-test score is a covariate. The fixed factor was comparison or intervention group assignment. Significant differences in the change of mean scores are reported at the 0.05 level.

Results

A total of 1,669 students in the intervention group and 392 students in the comparison group completed pre-tests or post-tests. For the purposes of this analysis, four was considered the minimum number of sessions required for the ESL curriculum to have the desired impacts on student knowledge, attitudes, and behaviors. Therefore, after removing students who completed less than four of the six curriculum sessions and those who did not complete both a pre-test and a post-test, the analysis included 1,549 students: 1,259 in the two intervention groups (562 in the school-based program in Fresno County, and 697 in the enriched program in Tulare/Kern Counties) and 290 in the comparison group. However, pre-tests, post-tests, and follow-up surveys were completed by only 245 students (67 in Fresno County, 142 in Tulare/Kern Counties, and 36 in the comparison group). Although the study design specified three groups of study (two interventions and one comparison), the results for the two intervention groups are combined since there was only one significant difference between those groups in the follow-up survey. This was not deemed sufficient to warrant the presentation of two sets of figures, particularly in light of the small number of responses for some follow-up questions. For the purposes of the pre/post analysis, the interventions were identical, since the parent workshops in the enriched intervention did not take place until after the post-tests were administered.

Respondent Demographics

The participants ranged from 13 to 20 years of age (with one 20 year old), with a mean age of 15.5 years for the intervention and comparison groups. Table 1 provides more detailed information on the demographic characteristics of the teenagers in the study.

Although efforts were made to match the comparison and intervention groups as closely as possible, there were some differences in terms of ESL level and race/ethnicity. While the intervention group students were split equally between ESL levels 3 and 4 (intermediate and advanced), the comparison group was more skewed, with 59.3% in level 3 and only 5.5% in level 4. In addition, Latinos represented 92% of the students in the intervention group, compared with 78% in the comparison group. Conversely, the comparison counties showed a higher percentage of Asian and Pacific Islander respondents (predominantly families from India).

Over half (54%) of intervention and 39% of the comparison group students reported previous experience working in agriculture. Nearly 95% of intervention and virtually all comparison group students who had worked in agriculture reported working as hired laborers, as opposed to working on their parents' farms. The students reported beginning to work in agriculture at between 1 and 18 years of age. Students reporting very young ages, such as 1 or 2, were presumably referring to being brought to the fields with their parents as babies and toddlers.

The mean age that students reported beginning to work in agriculture was slightly under 14 years for both groups. When students who reported beginning fieldwork under the age of 12 were excluded from the analysis, the mean age increased to 14.5 and 14.6 for the intervention and comparison county students, respectively.

Approximately two-thirds of both intervention and comparison group students who reported working in agriculture did not do so at all when school was in session (table 2).

Table 1. Characteristics of study population.

Characteristic	Intervention Group (%)	Comparison Group (%)
Grade	(*n* = 1252)	(*n* = 288)
Grade 8	0.0	0.3
Grade 9	38.7	44.4
Grade 10	35.9	26.0
Grade 11	15.5	21.9
Grade 12	10.0	7.3
ESL level	(*n* = 1149)	(*n* = 290)
Level 1	8.6	4.5
Level 2	26.1	30.7
Level 3	32.5	59.3
Level 4	32.9	5.5
Gender	(*n* = 1252)	(*n* = 286)
Male	55.8	54.2
Female	44.2	45.8
Race/ethnicity	(*n* = 1250)	(*n* = 289)
Latino or Hispanic	91.7	77.5
White, non-Hispanic	1.0	0.0
Asian, Asian American, or Pacific Islander	6.3	17.3
African American/Black	0.2	0.3
Other	0.9	4.8
Languages spoken	(*n* = 1262)	(*n* = 295)
Spanish	90.6	78.7
Hmong	5.8	2.8
Indigenous language	1.8	1.0
Punjabi	1.7	11.2
Other	2.7	15.0

Table 2. Number of hours worked in agriculture.

	When school is in session		During summers and holidays	
	Intervention (n = 547) (%)	Comparison (n = 76) (%)	Intervention (n = 630) (%)	Comparison (n = 107) (%)
Not at all	64.9	68.4	2.7	6.5
1-10 hours/week	23.9	21.1	28.9	32.7
11-20 hours/week	7.3	5.3	13.8	12.1
21-30 hours/week	1.6	2.6	16.2	13.1
Over 30 hours/week	2.2	2.6	38.4	35.5

Of those who did work while school was in session, approximately 25% worked between one and ten hours a week, while roughly 10% worked over eleven hours per week. Not surprisingly, considerably more students worked in the fields during holidays and summer vacations.

Exposure to Health and Safety Messages

The students reported varying degrees of exposure to health and safety messages. Three-fourths (74.1%) of intervention and 67.4% of comparison group students reported on the pre-test that their parents had spoken to them about health and safety in the fields. However, only 22.0% of intervention and 14.9% of comparison group students reported receiving other classes or training on agricultural health and safety at the time of or prior to the pre-test. Due to space limitations in the survey, it was not possible to ascertain whether students were referring to classes at work or at school.

Approximately one-fourth of students working in the fields during the summer following the intervention reported other exposures to health and safety messages. Employers were the main source of health and safety information for students in the intervention group, followed by parents.

Accidents and Illnesses

Of students working in agriculture prior to receiving the curriculum, 14.8% of those in the intervention and 20.3% of those in the comparison group reported being in an accident or having a work-related illness on the pre-test. An additional 18.8% of intervention and 10.6% of comparison group students reported "near misses," i.e., narrowly avoiding accidents or injuries. The survey did not ask about specific jobs or tasks that the youth were performing, so it was not possible to assess whether the accidents or near-misses are related to the jobs they had. The most frequently reported types of injury or illness were: accidents associated with a vehicle, machinery, or ladder; illness due to heat, sun, or not drinking sufficient water; pesticide-related illness; and cuts.

Impacts on Knowledge

Intervention group students demonstrated significantly greater increases in knowledge of laws, hazards, solutions, and resources to report problems. The percentage of intervention county students who reported knowledge of laws protecting teen agricultural workers increased from 17% at baseline to 67% at post-test to 57% at follow-up. Comparison group students went from 13% to 13% to 18%. The follow-up survey included an open-ended question asking students to name specific laws that protect agricultural workers (fig. 1). Nearly 90% of intervention group students could name one or more laws, compared with only 38% of comparison group students. Over 40% of intervention group students could cite two or more laws, compared with less than 20% in the comparison group.

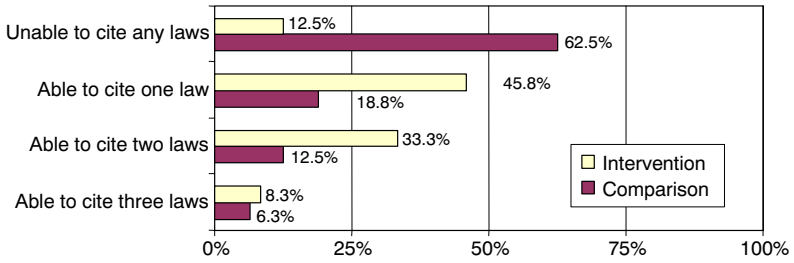

Figure 1. Percentages of respondents able to cite laws protecting agricultural workers: Follow-up survey.

The laws most frequently cited by intervention group students in the follow-up survey were those regarding the ages at which youth can legally perform specific tasks in the fields, the right to clean bathrooms, laws governing the number of hours teens can work in the fields, and the right to clean drinking water.

The pre- and post-tests included an open-ended question asking students to identify up to three health and safety problems they might encounter working in agriculture. Approximately two-thirds of students in both groups were able to mention at least one health and safety problem on the pre-test. That figure rose to 92% for intervention group students on the post-test, compared with 77% of comparison group students. The percentage of intervention group students able to identify three health and safety problems increased from 42% to 79%, while remaining virtually unchanged for comparison group students.

The most commonly identified health and safety problems on both the pre- and post-tests were pesticide-related issues, water issues (including access to clean water, drinking sufficient water, and avoiding dirty water, such as from irrigation canals), accidents, and ergonomic issues, such as lifting heavy items without asking for help. Findings for being able to articulate solutions to hazards closely parallel the results for naming hazards. Approximately two-thirds of students in both groups were able to identify one or more health and safety solutions in the pre-test. At post-test, that figure rose to 92% for intervention group students, while remaining virtually unchanged in the comparison group.

In addition to naming a greater number of health and safety problems, intervention group students were able to articulate more specific problems and solutions in open-ended questions in the post-test and follow-up surveys. Many intervention and comparison group students were able to cite general hazards such as tractors or ladders. However, the intervention group students displayed significant increases with respect to identifying specific hazards discussed in the curriculum, such as riding a tractor when someone else is driving or climbing a ladder over 20 feet tall, which was not the case for comparison group students. (While the law prohibits only teens under the age of 16 from climbing a ladder over 20 feet tall, respondents generally cited the height of the ladder, with reference to age.)

Impacts on Attitudes

The curriculum evaluation also measured changes in attitudes, including heightened awareness of the dangers inherent in agricultural labor and strengthened perceptions that youth can take concrete steps to avoid work-related accidents and illnesses. Specific attitudes that changed the most from pre-test to post-test were the belief that it is dangerous to ride a tractor when someone else is driving, perception of their own ability

Table 3. Attitudes toward health and safety.

	Pre-test		Post-test		
	Intervention (n = 1255) (%)	Comparison (n = 287) (%)	Intervention (n = 1255) (%)	Comparison (n = 287) (%)	p Value[a]
It's dangerous to ride on a tractor when someone else is driving (% agree)	79.4	79.4	91.6	87.9	<0.05
There's not much I can do to avoid accidents or illnesses in the fields (% disagree)	82.7	81.2	90.1	80.9	<0.01
Working with pesticides can cause health problems (% agree)	89.3	90.6	95.1	87.1	<0.01
Sometimes I think it's not worth trying to improve conditions in the fields, because nothing is going to change (% disagree)	87.7	83.5	90.7	83.6	<0.01
There's nothing wrong with asking for help when lifting heavy objects (% agree)	85.8	88.4	88.7	91.0	NS
I could get hurt lifting heavy objects without asking for help (% agree)	90.5	92.4	93.2	94.4	NS
Drinking water from irrigation canals or pipes may harm your health (% agree)	83.7	86.1	85.9	86.9	NS
If I see someone doing something unsafe, I should say something to them (% agree)	93.0	95.1	95.4	93.7	NS
It's important to drink a lot of water when working in the sun (% agree)	90.3	93.7	92.1	93.8	NS
It's important to read all signs before entering a field or orchard (% agree)	95.9	97.9	96.8	97.9	NS
I prefer not to report health and safety problems in the fields because my parents or relatives may get upset with me (% disagree)	96.6	94.4	96.5	91.7	<0.01

[a] The p-values refer to the differences between the intervention and comparison groups at post-test. There were no significant differences between the groups at pre-test.

to implement measures to avoid accidents or illness in the fields, and attitudes regarding the dangers of pesticide exposure (table 3).

The follow-up survey asked students about their awareness of health and safety problems, compared with their awareness of those issues during previous experiences working in agriculture. Fully 92% of intervention group students reported being more aware of health and safety problems, compared with 63% of comparison group students. The majority (69%) of intervention group respondents attributed greater awareness to the ESL classes. However, despite greater awareness of health and safety hazards, the percentage of respondents who reported noticing actual problems in the fields decreased considerably, from 19.6% to 10.6% among intervention group students, and from 21.1% to 8.3% among comparison group students. Issues cited included dirty bathrooms, lack of water for drinking or washing hands, workers not using protective gear, unsafe ladders, workers eating in the fields, being asked to lift heavy items, cuts and sprains, and coworkers fainting from exhaustion after reportedly being forced to work 16-hour days.

Table 4. Individuals to whom students would report problems: pre and post-test.

	Pre-test			Post-test		
	Intervention (n = 1258) (%)	Comparison (n = 290) (%)	p Value[a]	Intervention (n = 1258) (%)	Comparison (n = 290) (%)	p Value[b]
Boss or foreman	83.5	77.6	<0.05	91.7	84.5	<0.01
Agency	54.7	56.9	NS	79.8	57.9	<0.01
Parent, guardian, or relative	47.1	43.8	NS	70.9	53.8	<0.01
Unrelated co-worker	44.4	35.9	<0.01	67.0	49.3	<0.01
Wouldn't report the problem to anyone	2.4	3.8	NS	0.7	1.7	NS

[a] Pre-test p-values refer to differences between the intervention and comparison groups at pre-test.
[b] Post-test p-values refer to differences between the intervention and comparison groups at post-test.

With regard to reporting health and safety problems, intervention group students showed larger increases in both the percentage who thought they would report problems, as well as the number of different agents to whom they would report those concerns (table 4). A GLM analysis confirmed significant differences at post-test with respect to the percentage of intervention and comparison group students who would report problems to a boss or foreman, an agency, parents or other relatives, and unrelated co-workers. Significant differences, however, were found with respect to two of these items at pre-test, so those post-test differences may not be associated with the intervention.

Impacts on Behaviors

Findings on behavior change suggest interesting patterns but are not conclusive due to the very low number of comparison group students included in the analysis.Overall, nearly half (49%) of intervention group students reported implementing new behaviors to protect their health and safety compared with previous times they had worked in the fields, which was true for 33% (N = 24) of comparison group respondents ($p < 0.01$). Nearly half (45%) of intervention group responses to an open-ended question regarding behavior changes referred to increased caution and greater use of protective gear to avoid accidents and illnesses, followed by increased use of clothing for protection from the sun (34%), drinking clean water (13%), and asking for help when lifting heavy items (8%).

In addition, a series of questions on the pre-test and follow-up surveys measured specific self-reported behavior changes among students who had worked in the fields prior to and following the intervention. As seen in table 5, significant differences were found with respect to wearing a long-sleeved shirt while working in the sun (% a lot of the time), riding on a tractor that someone else was driving (% never), and wearing a hat while working in the sun (% a lot of the time). A GLM analysis confirmed these results. The largest behavioral changes among intervention students were the percentage of youth under the age of 16 who reported not working with pesticides or driving a tractor. The comparison group, however, also showed changes, such that differences between the intervention and comparison groups were not significant. Exposure to the pre- and post-tests may have encouraged students in the comparison group to think about the issues or seek more information on their own, leading to changes in reported behavior.

Another promising behavior is that over half (57%) (N = 13) of intervention group students noticing health and safety problems discussed that with someone else. Of those who reported a problem, 57% talked with a foreman, 29% with a coworker, and 14% discussed the problem with a parent or guardian.

Table 5. Behavior change: pre-test and follow-up.[a]

	Pre-test			Follow-up		
	Intervention (%)	Comparison (%)	p Value[b]	Intervention (%)	Comparison (%)	p Value[c]
Worked with pesticides under age 16 (% no)	70.8 (*n* = 248)	76.3 (*n* = 38)	NS	98.8 (*n* = 84)	100.0 (*n* = 10)	NS
Drove a tractor under age 16 (% no)	81.8 (*n* = 253)	89.7 (*n* = 39)	NS	98.8 (*n* = 82)	90.0 (*n* = 10)	NS
Lifted something heavy without asking for help (% never)	55.7 (*n* = 458)	61.4 (*n* = 70)	NS	83.1 (*n* = 154)	78.3 (*n* = 23)	NS
Wore a long-sleeve shirt while working in the sun (% a lot of the time)	78.0 (*n* = 459)	80.0 (*n* = 70)	NS	93.5 (*n* = 154)	78.3 (*n* = 23)	<0.01
Rode on a tractor someone else was driving (% never)	78.3 (*n* = 461)	78.6 (*n* = 70)	NS	87.0 (*n* = 154)	78.3 (*n* = 23)	<0.01
Wore a hat while working in the sun (% a lot of the time)	88.5 (*n* = 461)	77.1 (*n* = 70)	<0.05	96.1 (*n* = 154)	87.0 (*n* = 23)	<0.05
Drank water from irrigation pipes or canals (% never)	90.2 (*n* = 461)	82.9 (*n* = 58)	<0.05	98.7 (*n* = 154)	95.7 (*n* = 23)	NS
Washed hands before eating any food (% a lot of the time)	75.6 (*n* = 459)	65.7 (*n* = 70)	NS	79.2 (*n* = 154)	78.3 (*n* = 23)	NS

[a] *n* values refer to the total number of students who responded to each question.
[b] Pre-test p-values refer to differences between the intervention and comparison groups at pre-test.
[c] Follow-up p-values refer to differences between the intervention and comparison groups at post-test.

The curriculum has also had extended effects beyond the students, with 73% of follow-up survey respondents reporting sharing information with others. The majority of those doing so shared information with parents (73%), followed by friends (32%), relatives (31%), and coworkers (19%).

Impact of Parent Workshop Attendance on Student Outcomes

A total of 240 parents of 173 students in Kern and Tulare counties attended workshops on agricultural health and safety, child labor laws, and strategies to help their teenagers address issues at work. While parents found the sessions informative, and most of those subsequently interviewed reported sharing information with their children and implementing protective changes, virtually no associations were found between parent participation in health and safety workshops and student knowledge, attitude, or behavior outcomes, as assessed by the follow-up survey. Knowledge of places to report health and safety problems was the only statistically significant difference between the two groups. However, despite being significant, those differences were not large: 57% of students whose parents attended a workshop reported knowledge of places to report problems on the follow-up survey, compared with 51% of students whose parents did not attend a workshop.

Effects of Modifying Variables

The evaluation assessed the impacts of modifying variables including: age, gender, number of educational sessions completed, length of time working in agriculture, prior exposure to safety information, and history of work-related injuries on student outcomes. Findings show that these variables had minimal, if any, impact. Significant differences at the $p < 0.05$ level were only detected with respect to gender and the number of curriculum sessions attended. An increase in the number of sessions attended was associated with a number of improved outcomes, particularly in the follow-up survey. While there were some differences between boys and girls with respect to specific knowledge and attitudinal questions, there were no particular patterns in that regard.

Qualitative Results

The qualitative findings help support the findings from the quantitative measurements. There was great enthusiasm for the curriculum among students, teachers, and parents who were involved in focus groups or interviews. Many students and teachers recommended that this curriculum be implemented in all schools with a large percentage of farm workers. Sixty students participated in focus groups. These revealed a high level of student interest in and enthusiasm for the curriculum. They were particularly excited to learn about the rights of agricultural workers and to learn of organizations that they could contact to report health and safety hazards in the fields. Students also reported sharing the information in the curriculum with parents, siblings, relatives, and coworkers. Many explained that their family members were very happy to receive this information, as many "didn't know about their rights and were really surprised" to learn about them. While students were familiar with the hazards in the fields, the information on solutions or steps they could take to reduce risks, as well as on their rights, was new to them, and they reported feeling excited to learn this. Another student reported telling her friends about the right to clean bathrooms, with positive results. She explained that "the bathrooms were really far away from where they were working, and I told them that they have the right to have them close by, and clean. They said something to their boss and he moved them closer. I helped them. I think the boss knew that something would happen if he didn't move the bathrooms closer." These examples of successful changes may reinforce continued efforts to improve conditions in the fields on the part of students receiving the curriculum and those with whom they share this information.

Fall focus group participants (who had worked in the fields during the summer following the curriculum) demonstrated high levels of retention despite a lapse of approximately six months between the curriculum and the focus groups. Many also reported implementing a range of behavior changes. Changes cited included staying away from recently sprayed fields, not drinking irrigation water, not eating in the fields, washing work clothes separately from other clothing, and taking work clothes off at home. They also reported increased confidence in their ability to protect their health and safety in the fields, and many spoke to others about what they learned in the classes. Student comments exemplifying behavior changes included the following:

"Now when we see a tractor spraying pesticides we know we have to stay far away."

"Because of the classes, I spoke to my dad, and my dad spoke to the foreman and they improved the conditions of the bathrooms."

"Now we wash our clothes separately. When I get home, the first thing I do is take off my clothes. Before we used to go straight to bed and lie down, but now we take off our clothes and take a shower when we get home." "I used to get on the tractors for fun, but now I don't anymore, because it's dangerous."

"We noticed that sometimes people put pesticides in a bottle, and that's a danger because someone could drink it."

Most teachers felt their students were interested in the curriculum and in many cases excited by it. A number of teachers reported that the curriculum was effective in stimulating classroom participation from an ESL perspective as well, since students often felt more confident discussing issues with which they had personal experience. As a teacher commented, "They were excited by the curriculum. It was important for them to learn that there are agencies that are there to help them. They didn't know that before. They knew some about the hazards, but had a very small amount of the information."

In addition to impacts on students, a number of teachers commented on the curriculum's impacts on parents. As a teacher explained, "Several kids wanted to take the information home. The parents who came to the workshop were listening and making comments; they said that before they wouldn't call to report problems because they might be fired, so they also learned about their rights." Virtually all teachers felt that this should become a regular part of the ESL curriculum in schools with large numbers of teen farm workers.

Finally, the parents' response to the workshops was very positive, and many noted that much of the information presented was new for them. As one explained, "I thought the workshop was going to be a waste of time. But it was very interesting and I learned a lot. They gave us sheets with information and telephone numbers to call. They told us about our rights, for example, that we have the right to talk to the *mayordomo* (foreman) if there's a problem." Almost all reported discussing what they learned in the workshop with their children. Many noted that this was the first time they had ever discussed health and safety in the fields with their children. One parent explained, "I already knew a lot of the things they talked about, but before this workshop it hadn't occurred to me to talk to my son about these things." Most parents reported behavior changes with respect to their children working in the fields, including: "I told my son not to wear the clothes he wears in the fields at home or in school, because it's full of chemicals," and, "I told my son that he should wash his hands before eating and that he shouldn't drink water unless he's sure it's clean. Since that meeting, we bring our own water to the fields so we can be sure we have clean water."

Although employers are required by law to provide water, in situations where workers feel too vulnerable to demand it, bringing their own water does provide protection. The 2006 California standard, Heat Illness Prevention, may also help ensure that workers now have easier access to water in the fields.

Discussion

The need for sustained education and outreach on agricultural safety and health for youth is evident through this study. Only one-fourth of the students reported receiving information about health and safety through other venues, including classes, work, or in the community. While 74% of the students reported on the pre-test that their parents had spoken to them about health and safety, focus groups with students and interviews with parents indicated that talking about health and safety was something new, and had happened as a result of either the curriculum or the parent workshops. It is possible that after participating in the curriculum, students had much more in-depth or more specific discussions about health and safety.

The evaluation findings indicate that the *Teens Working in Agriculture* ESL curriculum is an effective means of reaching youth who work in agriculture and teaching about agricultural safety and health. Participating teachers rated the curriculum highly,

and those who came from farm worker families themselves were particularly enthusiastic about providing teens with this information.

There was a significant impact in terms of the knowledge gained by the students who received the curriculum. Short-term impact is evident in the analysis of the pre- and post-tests, but there were also very high levels of retention of information demonstrated in the follow-up survey that was carried out after the summer (up to 6 to 8 months after the curriculum). While the comparison group also showed some gains in knowledge in the follow-up survey, the intervention group did much better in open-ended questions that asked them to name specific laws (90% compared to 33% of students). In the post-test, the intervention group could also name a greater number of health and safety problems and solutions, and could articulate more specific examples of each of these than the comparison group.

Knowledge gains about child labor laws were mixed. The post-test showed a significant change with respect to the percentage of teens who could name the minimum age required for farm work, but this dropped off dramatically by the follow-up survey. There was also not much change between the pre- and post-tests with respect to knowledge of the tasks that youth under 16 are not allowed to do in the fields. However, youth who received the curriculum did show a gain in knowledge about the tasks that youth older than 16 are able to do. It is likely that it is easier to remember that youth over 16 are able to do most tasks in the field, as opposed to remembering which tasks are restricted for youth under 16.

Greater increases in attitude and behavior change had been anticipated. Youth's scores on the pre-test in both the intervention and comparison groups were very high (87% "correct" responses). While the questionnaire was field tested for validity and reliability, this section consisted of a series of dichotomous "agree/disagree" questions, which may have increased the likelihood of students selecting the correct response. There were significant differences between the groups when the analysis looked at the percentage of students who answered all attitudinal questions correctly. The intervention group changed from 37% at pre-test to 53% at post-test, whereas the comparison group showed only a slight increase from 37% to 42% ($p < 0.01$).

Although intervention group students reported a greater feeling of awareness of health and safety problems when they worked in the fields over the summer, there was a drop in the percentage of students who reported actually noticing health and safety problems in the fields (compared to the previous summer of work). This is a surprising finding with several possible explanations, including "question fatigue," as students may have realized that they would have to respond to additional follow-up questions if they reported that they noticed any problems. Other possible explanations are: that the students did not retain the knowledge or ability to identify problems in the field or did not feel comfortable identifying these problems; that they had a better understanding of the question so that they realized the "problems" they had identified at pre-test were not actually health and safety problems; or, though less likely, that they found themselves working on farms with fewer health and safety problems than in previous years.

Changes in behavior were measured through the follow-up survey, comparing the students' summer work experience after receiving curriculum to their experience the previous summer. As with attitudes, the scores for "correct" behavior on the pre-test were higher than expected. However, there is not sufficient power to compare the groups because of low response rates to the follow-up survey. Nonetheless, there are some encouraging patterns of behavior among students who received the curriculum, including that almost half reported implementing new behaviors to protect their health and safety compared to previous times they worked in the fields. Another promising behavior is that over half of the intervention group students who noticed health and safety problems

talked to someone about them. In the focus groups the following fall, students reported a variety of behavior changes, including staying away from recently sprayed fields, not drinking irrigation water, not eating in the fields, and washing work clothes separately from other clothing. The fact that 73% of follow-up survey respondents reported sharing information learned in classes with parents, siblings, other relatives, friends, and coworkers indicates the important role youth can play in educating other farm workers.

In addition, the study suggests that information given to parents through community workshops does not result in increased positive outcomes among their children. In fact, there were no significant differences in knowledge, attitude, or behavior among students whose parents attended the workshops and students whose parents did not attend. However, comparisons between these groups are hampered by lower numbers than necessary for sufficient statistical power. Reaching teens through their parents and the community workshops were a component of this intervention, since studies have shown that change is more likely to occur in a community where there are multiple strategies addressing the same issue (Gielen, 1992; Green et al., 1990). However, it was a very time consuming and expensive process, since outreach efforts for the workshops were very labor intensive. In addition, transportation, food, and childcare were provided at each site, as well as raffles and incentives for parents to attend. It would be interesting to explore other methods for reaching youth through people who play a significant role in their lives.

Data Limitations

This evaluation study was not able to include sufficient numbers of students who had completed all three measures (pre-test, post-test, and follow-up surveys) in order to meet power calculation criteria. Although this does not affect the significance of the results, it may limit our ability to detect more subtle differences between groups at follow-up. In addition, the high ratio of intervention to comparison group students may also skew some of the results. All findings from the follow-up survey should therefore be interpreted with caution.

The lower response rates for the follow-up survey across all groups was a function of several factors, including a lower than expected number of students working in the fields over the summer and difficulty reaching students by phone. The dramatically lower numbers in the comparison group involved several additional factors, including logistical issues at some schools and the fact that it was difficult to recruit teachers to participate in a comparison group, where there was little immediate benefit to their students or schools. Finally, although efforts were made to recruit students from similar schools and agricultural regions as those in the intervention group, there were some demographic differences between the groups, and a lower than estimated percentage of comparison county students worked in agriculture the summer after the curriculum. This resulted in a lower number from which to draw for inclusion in the follow-up surveys, and may have had other undetermined effects on the results.

Another limitation, characteristic of all survey-based studies, is that all information is based on self-report. With regard to the follow-up survey, the difficulty with self-report is two-fold: (1) students may not accurately recall behaviors that took place several months prior, and (2) students may overestimate positive changes in behavior to "please" the researchers. Additionally, the analysis of the curriculum's impacts on behaviors is based on recall data over unequal amounts of time. Behavioral questions on the pre-test referred to work the previous summer, i.e., approximately eight months earlier, whereas the follow-up test was generally administered to students within two to four months of

working in the fields. This difference may have affected the accuracy of some responses, particularly on the pre-test.

The design of the survey may have affected the measurement of attitudes. For example, the effort to make the survey easier to implement through close-ended questions was limiting, particularly for measuring attitudes, where students appeared to be able to easily determine what the "right" answer was. Finally, "testing effect" likely played a role in the increases seen in the comparison group, particularly between the post-test and the follow-up survey. Students may have recognized what the answer should be, and they may have been more cognizant of the issues during their summer work experience because they participated in the pre- and post-tests.

Conclusion

Hired teen farm workers form a group of workers that is difficult to identify and reach in sizeable numbers. This study shows that school-based ESL classes can serve as a much-needed access point for young farm workers, as over half of the intervention group students reported working in agriculture. The research findings also demonstrate the effectiveness of the *Teens Working in Agriculture* ESL curriculum as a means of teaching adolescent farm workers about agricultural health and safety. Although integrating new curricula into classes can be challenging in the current standards-driven educational environment, the fact that this curriculum was so well received by the participating teachers indicates it is a model than can be broadly disseminated in agricultural regions where the use of hired labor is prevalent.

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