Evaluation of a Farm Safety Day Program: Participants and Non-Participants Over a One-Year Follow-Up Period

D. M. McCallum, M. B. Conaway, S. J. Reynolds

ABSTRACT. *Farm safety day programs are attended each year by thousands of children in rural communities. This evaluation of a national farm safety day program assessed changes in knowledge and reported behaviors among safety day participants, aged 8 to 13 years, and a comparison group of children who did not attend a safety day. The outcome evaluation involved a quasi-experimental design with participants and non-participants, measured with a pre-test, three-month telephone follow-up, and one-year telephone follow-up survey. The study included 621 children from a sample of 28 safety days administered throughout North America and 413 non-participants recruited from the same or nearby communities. The survey instruments measured participants' knowledge of safety hazards, knowledge of appropriate safety behaviors, and current practices with regard to safety behaviors. While both participants and non-participants showed improved safety knowledge and safe behavior scores over time, there were significantly greater increases in knowledge and behaviors for the safety day participants than for the non-participants. Improvements occurred for all age levels and were sustained through the one-year follow-up assessment. This study contributes to the body of evidence that such safety programs can have a long-term effect on the knowledge and safe practices of children who attend them.*

Keywords. *Agricultural safety, Child agricultural safety, Evaluation, Farm safety, Safety days, Safety education.*

Agricultural production is among the most hazardous industries, with some of the highest rates of work-related injuries and deaths (NIOSH, 2004). Furthermore, this industry is unique in its high level of participation by children and adolescents. In addition to the significant risk of work-related injuries, children and youth on farms are also exposed to agricultural hazards in their play activities, as well as being in close proximity to adults who are working. A report by the USDA National Agricultural Statistics Service (NASS, 2004) estimated that 22,648 agricultural-related

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The authors are **Debra Moehle McCallum,** PhD, Senior Research Scientist, Institute for Social Science Research, University of Alabama, Tuscaloosa, Alabama; **Michael B. Conaway,** JD, Project Coordinator, Capstone Poll, Institute for Social Science Research, University of Alabama, Tuscaloosa, Alabama; and **Susan J. Reynolds,** MS, Executive Director - Programs, Progressive Agriculture Foundation, Birmingham, Alabama. **Corresponding author:** Debra Moehle McCallum, Institute for Social Science Research, Box 870216, University of Alabama, Tuscaloosa, AL 35487-0216; phone: 205-348-3820; fax: 205-348-2849; e-mail: dmccallu@bama.ua.edu.

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injuries occurred to children under the age of 20 who lived on, worked on, or visited a farm in 2001, at a rate of 1.4 injuries per 100 farms.

In response to the high levels of risk for children in agricultural settings, farm safety days (also known as farm safety day camps) are one of a variety of educational programs offered in many rural communities as a format for teaching children to use safe methods of play and age-appropriate work on farms and ranches. These safety days generally take the form of one-day events conducted through schools or for the broader community and offer lessons covering a variety of rural and agricultural safety issues. Typically children move in small groups through a number of stations or sessions where they learn about specific safety topics in 10- to 20-minute presentations over a four- to six-hour period.

A number of organizations, such as the Cooperative Extension Service, FFA, 4-H, Farm Safety 4 Just Kids, Farm Bureau, and hospitals, sponsor these events. One of the largest programs, supporting more than 370 safety day events each year throughout North America, is sponsored by the Progressive Agriculture Foundation (PAF) with funding from more than 90 corporate and foundation sponsors, as well as numerous individual contributors. PAF provides local safety day organizers with training, resources, support, and networking opportunities needed to conduct a community safety event that offers age-appropriate, effective lessons in topics related to farm safety. Most participants in these safety days are between the ages of 8 and 13, although some events include adults or whole families. The events range in size from 20 to 800 participants, with an average participation of approximately 150. The Progressive Agriculture Safety Day Program™ provides the volunteer coordinators with a Planning Manual and a Topics and Activities Manual that contains more than 23 agriculture safety related topics. Safety day organizers then select topics and lesson plans to suit the type of farming or ranching in their area or to meet other local needs.

Safety days such as these are attended each year by thousands of children. The goal of these events is to make children safer on farms and ranches, seeking to prevent injuries by increasing safety-maximizing behaviors. These programs, however, have been the subject of relatively little careful evaluation of the effectiveness of this format for accomplishing the goals of increasing safety awareness and knowledge, increasing safe behaviors, and reducing injuries among children on farms and ranches. As reviews of the research have indicated, empirical evaluations of farm safety education programs in general, and farm safety days in particular, are limited (Baker et., 2001; DeRoo and Rautaianen, 2000; Hartling et al., 2004). They are often formative in nature, measure only short-term or intermediate outcomes, lack control or comparison groups, or have limited generalizability; and the majority of these evaluations remain as unpublished reports. Nevertheless, given these limitations, DeRoo and Rautaianen (2000) cite several promising unpublished studies, and there are more recent studies as well, reporting increases in correct responses to knowledge questions, more safety-appropriate responses to attitude questions, and self-reported or intended changes in safety-related behaviors (e.g., Arnold et al., 2006; McCallum et al., 2005). It has also been found that parents overwhelmingly believe the programs are beneficial to their children, and a significant portion of them report changes in their own and their child's behavior (Arnold et al., 2006; McCallum et al., 2006). Significant financial and human resources are devoted to these safety days and camps, and communities and sponsors

alike assume they are part of the solution to childhood farm-related injuries. Yet additional studies are needed to determine their effectiveness and value.

This report presents data that are part of a larger project evaluating the PAF safety day program. It extends previous efforts to evaluate such safety education programs by including two important aspects of a comprehensive evaluation: (1) assessment of both short-term and long-term (one year) changes in knowledge and behaviors among program participants, and (2) comparison of program participants to a non-participant group. Rudimentary data on reported injuries were also collected.

Methods

Overview

The outcome evaluation involved a quasi-experimental design with participants and non-participants, measured at pre-test, post-test (participants only), 3- to 6-month follow-up, and 12- to 15-month follow-up. (Hereafter, the two follow-ups are referred to simply as the 3-month follow-up and 1-year follow-up.) The evaluation was conducted with a selected sample of 28 safety days for children 8 to 13 years old. Safety day participants were selected from these 28 sites, and non-participants were recruited from the same or nearby communities. The survey instruments measured participants' knowledge of safety hazards, knowledge of appropriate safety behaviors, and their current practices with regard to safety behaviors.

Sample

All *Progressive Farmer* Farm Safety Day Camps® (now the Progressive Agriculture Farm Safety Day Program™) held between March and October 2002 and serving children ages 8 to 13 were eligible for participation in the evaluation. From the 253 eligible safety day sites, a sample of 28 sites was selected for the outcome evaluation portion of the project. These sites were selected randomly with some constraints to ensure that the final sample was representative of various sizes, geographic locations, and the full calendar timeframe of safety day offerings (March to October). Seventeen of the safety days in the sample were community-based (i.e., recruitment is done throughout the community, and all children within the targeted age range are welcome), and eleven of the safety days were school-based (i.e., the children participate as part of a school activity, and recruitment is limited to one or two grades within the school). The school-based events tend to be considerably larger than the community-based events. The choice of safety day type (community vs. school-based) is made by the local safety day coordinator and planning committee. Within the sites, a random sample of children was selected for participation in the follow-up telephone calls. The size of the selected follow-up sample for each site was roughly proportional to the size of the event, although participants in very small sites (<30 children) were oversampled.

For each site in the sample of 28, a comparison group of children in the 8 to 13 age range who did not attend the farm safety day was recruited from the surrounding community. Recruitment of the comparison group proceeded in several ways, depending on the community and the resources of the safety day coordinators who assisted with recruitment. For school-based events, where possible, suitable classes that had

Table 1. Distribution of sample.

Event Type	Safety Day Participants	Non-Participant Comparisons	Total
Community-based	275	209	484
School-based	346	204	550
Total[a]	621	413	1034

[a] For the non-participants, there was no difference in their experience based on event type. They were simply recruited to provide comparison with participants in a community or school-based safety day event.

not attended the event were used for the comparison. Where this was not feasible and for community-based events, other local groups and contacts were used to identify suitable non-participants for comparison. If these activities failed to produce a sufficient sample of non-participants, then telephone solicitation of eligible children from a random list of phone numbers was used to obtain the most appropriate comparison group possible.

To increase initial compliance and to reduce later attrition, children who participated in the survey received $5.00 per completed interview. Only participants with complete data, i.e., pre-test, 3-month follow-up, and 1-year follow-up, are included in the analyses presented here. Table 1 shows the final sample for the four groups in the study design.

Procedures

At the selected safety day sites, a written pre-test and post-test were administered to children age 8 years and older. (At some safety days, there were younger participants who were not included in the evaluation.) The children read and completed the pre-test and post-test individually, although they could ask for help with reading if needed. In most community-based sites and in some school-based sites, these tests were completed in large or small group sessions at the start of the safety day and again at the end of the day. In some school-based sites, the pre-test was administered at school a day or two before the event took place, and the post-test was administered a day or two later. Some of the non-participant comparison children completed their pre-test in a group setting, similar to the participants; others completed the pre-test by telephone. (Because the non-participant comparison group did not take a post-event test, these data are not included in this analysis.)

Three to six months following the pre-test (and safety day), a parent or guardian of the target participant or non-participant was contacted by telephone for the follow-up survey. These calls were made by experienced telephone interviewers employed by the Capstone Poll at the University of Alabama. The selected child and his or her parent or guardian were interviewed. The parent's interview provided an opportunity to establish rapport with the parent, give the parent an idea of the types of questions the child would be asked, and gain additional information related to the child's activities. As parents provided only follow-up information, their data are not used in the current analysis to address the question of changes in the knowledge and behavior of safety day participants. Upon completion of the parent and child interviews, the mailing address was verified so the $5.00 incentive could be mailed to the child, and permission was gained to call again about 10 to 12 months later. When the participant was called for the 1-year follow-up, the same procedure was followed.

Instruments

Written pre-test questionnaires and telephone-administered follow-up questionnaires were developed to be as closely correspondent as possible in light of their differing administration formats. Behavior questions were answered in a frequency format (e.g., How often do you drive an ATV?). Most knowledge questions were presented in a true/false format, with a couple of multiple-choice items. The pre-test and follow-up surveys assessed knowledge and behaviors related to first aid and to safety around animals, ATVs, farm equipment, flowing grains, tractors, bicycles, lawn mowers, sun exposure, fire, and electricity. Children also were asked about the amount of time they spend on farms or ranches. There were approximately 40 questions on the pre-test and follow-up instruments. This report focuses on 27 questions concerning safety-related knowledge and behavior that were identical on the pre-test and follow-up surveys. An additional question about recent injury experiences was also analyzed. The remaining items, which were not identical at all time points, recorded demographic information, open-ended reports of behavior changes, and additional items related to awareness of or experience with injuries.

Results

Frequencies for several demographic characteristics of the sample are presented in table 2. At the time they completed the pre-test, the children had a median age of 10, with a mean of 10.15, and they were almost equally divided between males and females and between community-based and school-based sites. Approximately 30% of the children in the sample reported living on a farm or spending time on a farm every day. The children in the safety day participant group were slightly younger, on average, than the comparisons ($t(1032) = -3.36$, $p < 0.001$); among the safety day participants, those in community-based events were younger than those in the school-based events ($t(619) = -3.39$, $p < 0.001$). The community-based safety days had a higher percentage of boys participating compared to the school-based safety days ($\chi^2(1) = 11.82$, $p < 0.001$). Overall, children in the comparison groups were less likely to live on a farm or be on a farm every day ($\chi^2(5) = 22.75$, $p < 0.001$ for "how often on a farm," and $\chi^2(1) = 13.94$, $p < 0.001$ for living on a farm). However, among both the participants and the comparisons, children in the community-based sites were more likely to live on a farm or be on a farm every day than children in the school-based sites.

Analysis Plan

The primary analysis of interest for testing the hypothesis that safety day participation improves knowledge and safe behavior is a repeated measures analysis of variance comparing participants and non-participants across time. The strongest demonstration of this effect would be an interaction between these two factors in which participants' knowledge and behavior improved following the safety day while non-participants remained unchanged. Community and school-based safety days differed somewhat, particularly in terms of size and targeted age range as well as self-selection factors; therefore, this factor was included in the analysis. Due to the substantial differences that were found across groups in terms of farm contact and the possibility that the effect of the safety day would be related to farm experience, living on or off a farm

Table 2. Demographic information.

		Safety Day Participants		Non-Participant Comparisons		
		Community	School	Community	School	Total
Age	8	24.3%	12.1%	12.4%	11.8%	15.4%
	9	25.1%	19.1%	23.0%	17.6%	21.2%
	10	20.0%	32.4%	14.8%	23.0%	23.7%
	11	12.7%	18.5%	22.5%	30.4%	20.1%
	12	12.4%	9.5%	17.2%	8.8%	11.7%
	13	5.5%	8.4%	10.0%	8.3%	7.9%
	Mean	9.79	10.19	10.39	10.32	10.15
Gender	Female	42.2%	56.1%	48.8%	51.2%	49.9%
	Male	57.8%	43.9%	51.2%	49.0%	50.1%
How often on a farm						
	Every day	43.3%	28.9%	31.1%	16.7%	30.8%
	Few days a week	9.1%	7.5%	8.1%	5.4%	7.6%
	Few days a month	17.5%	12.7%	14.4%	13.7%	14.5%
	Few days a year	22.5%	28.0%	25.4%	38.2%	28.0%
	Never	7.3%	21.7%	20.1%	26.0%	18.4%
	Don't know	0.4%	1.2%	1.0%	0%	0.7%
Live on a farm						
	Yes	42.9%	28.0%	31.6%	15.7%	30.3%

was added to the analysis as an independent variable. Finally, because knowledge and behavior would be expected to differ somewhat across the age range included in this study, age was used as a covariate in the analyses to control for the possible effects of age differences among the groups. Thus, for knowledge and behavior, a repeated measures analysis of covariance was conducted which included age as a covariate; three between-subjects factors: safety day participants vs. non-participants, event type (community-based vs. school-based), and farm residence (yes or no); and differences across time as a within-subjects factor.

Knowledge

To assess changes in knowledge across time, a knowledge score was computed to reflect the percentage of the 11 knowledge items that were answered correctly. This knowledge score was computed for the pre-test (time 1), 3-month follow-up (time 2), and 1-year follow-up (time 3) responses for all subjects. Means and standard devia-

Table 3. Knowledge scores by event type, participant status, and farm residence.

			Safety Day Participants		Non-Participants	
	Time Factor	Event Type	Mean	SD	Mean	SD
Live on farm	Pre-test	Community	77.6	18.6	80.4	12.9
		School	72.3	15.8	77.3	18.0
	3-month follow-up	Community	84.8	11.3	80.4	15.8
		School	82.3	13.3	84.1	13.9
	1-year follow-up	Community	86.3	11.4	86.8	11.3
		School	83.9	14.4	85.2	14.9
Do not live on farm	Pre-test	Community	73.2	17.6	72.7	18.1
		School	68.7	17.1	74.5	15.2
	3-month follow-up	Community	84.3	12.9	80.3	14.1
		School	81.2	13.1	76.0	14.6
	1-year follow-up	Community	85.9	12.1	81.7	14.5
		School	84.8	12.7	81.2	13.5

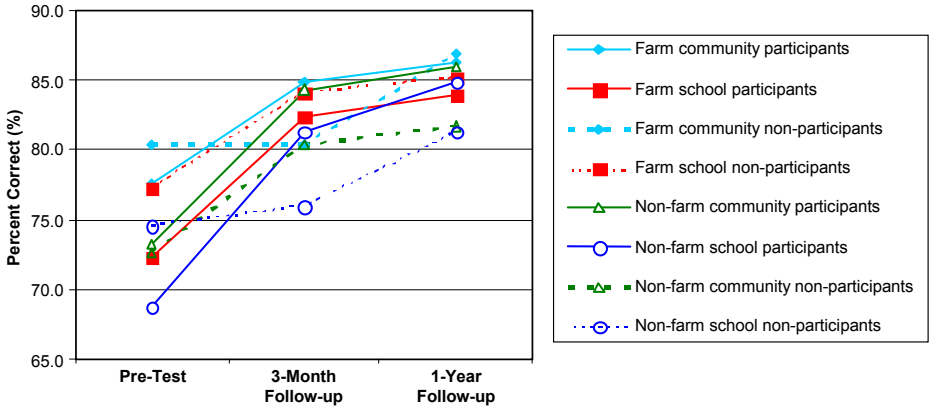

Figure 1. Knowledge scores.

Table 4. Repeated measures analysis of covariance on knowledge scores.

	F	df	Sig.
Age	32.44	1	0.000
Time	10.91	2	0.000
Time × Age	3.25	2	0.039
Participant/Non-participant	1.38	1	0.241
Event type	7.09	1	0.008
Farm residence	14.16	1	0.000
Time × Participant/Non-participant	13.30	2	0.000
Time × Event type	.83	2	0.437
Time × Farm residence	2.29	2	0.102
Participant/Non-participant × Event type	3.21	1	0.074
Participant/Non-participant × Farm residence	3.53	1	0.061
Event type × Farm residence	.04	1	0.845
Time × Participant/Non-participant × Event type	1.10	2	0.332
Time × Participant/Non-participant × Farm residence	1.03	2	0.357
Time × Event type × Farm residence	4.54	2	0.011
Participant/Non-participant × Event type × Farm residence	.00	1	0.987
Time × Participant/Non-participant × Event type × Farm residence	2.65	2	0.071

tions are presented in table 3, the results are plotted in figure 1, and the ANCOVA results are presented in table 4.

The three significant main effects in this analysis reveal an overall increase in knowledge scores across time (means for pre-test = 74.5; 3-month = 81.6; 1-year = 84.4); somewhat higher knowledge scores for participants in community events (heavier lines; mean = 81.3) than those in school-based events (thinner lines; mean = 79.1); and higher knowledge scores for children who live on farms (filled symbols; mean = 81.7) than those who do not (open symbols; mean = 78.6). Most importantly for determining the effectiveness of the safety day program, there is a significant interaction of time by participant (solid lines)/non-participant (broken lines). Marginal means, shown in table 5, reveal a greater improvement across time for the safety day participants.

For the safety day participants, there is a significant difference between the pre-test and 3-month follow-up scores, as well as a significant difference between the pre-test

Table 5. Knowledge scores for participant × time interaction.

Time Factor	Safety Day Participants	Non-Participants
Pre-test	73.2	75.8
3-month follow-up	83.4	79.8
1-year follow-up	85.4	83.5

and 1-year follow-up scores, but no significant increase from the 3-month to the 1-year follow-up. Therefore, the improvements in knowledge occur soon after the safety day and are maintained for at least a year following the pre-test measure. For the non-participants, a non-significant increase occurred between the pre-test and the 3-month follow-up, with a significant increase from the 3-month to the 1-year follow-up. Participants and non-participants are significantly different from each other at each point in time. Thus, safety day participants start out with slightly lower knowledge scores than non-participants, but they are significantly higher following the safety day and are still slightly higher a year later. Further analysis of the significant time × event type × farm residence interaction shows a significant difference between the pre-test and 1-year follow-up for community non-farm residents, school non-farm residents, and community farm residents, but no significant differences across time for school farm residents (although there are increases for this group, they did not reach the level of statistical significance achieved in the other groups).

Overall, these results show clear increases in knowledge for the safety day participants, as well as improvement for the non-participants, from the pre-test to the 1-year follow-up. It is not clear why the non-participants should increase their knowledge, but it is most likely a result of factors such as maturation, sensitization to the topic, and repeated testing. However, the significant interaction, a result of larger increases in knowledge for the safety day participants, reveals the potential added value of the safety day experience over and above these other possible effects.

To look at effects across age groups, mean knowledge scores for participants and non-participants at each of the time points are graphed in figure 2. A slight increase in knowledge scores occurs with increasing age, as would be expected. Most importantly, it is clear from the graph that improvements in knowledge from the pre-test (solid lines) to the follow-ups (3-month = broken lines and 1-year = dotted lines) oc-

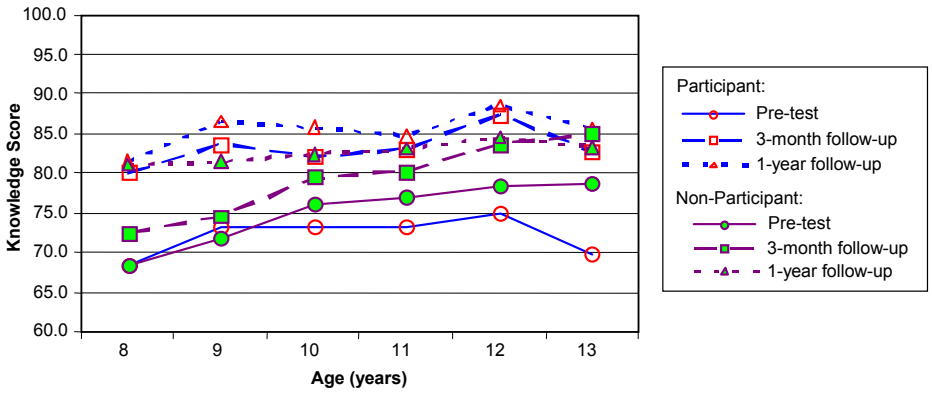

Figure 2. Knowledge by age.

curred for all age levels. Differences between the pre-test and follow-up scores are statistically significant for all ages in both the participant and non-participant groups.

Behavior

Analyses of the 16 individual behavior items on the pre-test and follow-up surveys indicated that more safety day participants were making the safest choice and fewer were making the riskiest choice at the time of the 3-month and 1-year follow-ups than at the time of the pre-test. For example, compared to the pre-test, on the follow-up surveys more participants reported they "never" ride a tractor while someone else is driving, and more reported they wear a helmet "very often" when riding an ATV. The various behaviors do have a variety of patterns, however. Six items showed an increase in safety from the pre-test to the 3-month follow-up and an additional increase from the 3-month to the 1-year follow-up (riding on tractors with others driving, riding in an enclosed cab when on a tractor, riding on lawnmowers with others driving, family having a list of emergency phone numbers, family having a fire extinguisher in the house, family having a fire extinguisher in the barn). Six others improved from the pre-test to the 3-month point and then remained unchanged at the 1-year follow-up (riding an ATV while someone else drives, wearing a helmet when riding or driving an ATV, picking up sticks and rocks before mowing the lawn, going inside wagons or bins of grain, being near PTOs, family having a first aid kit). The remaining four items increased toward safety from the pre-test to the 3-month point and then declined at the 1-year follow-up, although none of them declined to the level of the pre-test (driving an ATV, wearing a helmet when riding a bicycle, being near large animals without a protective fence, wearing sunscreen).

To conduct an overall analysis of behavior change, a single safe behavior score, similar to the knowledge score, was computed from the responses to the 16 behavior items. This score reflects the extent to which the child reported engaging in safe behaviors or avoiding risks. To combine the items, which were not uniform in the number of response choices, each response was coded as a percentage such that the most safe response choice had a score of 100% and the most unsafe response was 0%; intermediate choices were given scores at equal intervals between 0 and 100, based on the number of behavior options given. (For example, on the question "How often do you ride on a tractor while someone else drives?" the assigned values were as follows: a few days a week = 0, a few days a month = 33, a few days a year = 67, and never = 100. Items with response choices of "never," "sometimes," and "very often," were scored as 0, 50, and 100, respectively.) The score on the safe behavior scale was computed as the mean of the values on the 16 behavior items. (Items that were not applicable to the child, such as frequency of wearing a bicycle helmet if the child does not ride a bicycle, were not included in this overall score.) These scores could range from 0 to 100, with higher scores indicating more safe behavior practices. Mean safe behavior scores for each group are shown in table 6, and the results are plotted in figure 3. The results of the repeated measures analysis of covariance are reported in table 7.

The two significant main effects appear clearly in figure 3, showing an increase in safe behavior over time (pre-test mean = 64.23; 3-month = 71.9; and 1-year = 71.6) and lower safety scores overall for children who live on farms (open symbols; mean = 64.3) compared to children who do not live on farms (closed symbols; mean = 74.2). This difference between those who live on farms and those who do not is significant at each time point, and the farm residence effect is not qualified by any interactions. The

critical time × participant (solid lines)/non-participant (broken lines) interaction is significant, accounted for by the presence of a participant/non-participant significant difference on the pre-test, with no participant/non-participant differences at the other two time points. Safety day participants had significantly lower safe behavior scores on the pre-test compared to the non-participants, and their increase in safe behaviors by the time of the 3-month follow-up was greater than that of the non-participants. There was no difference from the 3-month to the 1-year follow-up for either group. These marginal means are presented in table 8.

For both the safety day participants and the non-participants, there is a significant difference between the reported safe behaviors on the pre-test and the 3-month follow-up and between the pre-test and 1-year follow-up, but no significant difference between the 3-month and the 1-year follow-up. Thus, there is a significant increase in safe behavior (or decrease in unsafe behavior) from the pre-test to the first follow-up, and this improvement is sustained up to a year later, with no change in either direction. While a significant behavior change is shown for the non-participants, it is not as large as the change for the safety day participants.

Looking at effects across age groups, the mean pre-test and follow-up behavior scores for participants and non-participants in each of the age groups are graphed in figure 4. As one would expect, a developmental trend for increasing risk (decreasing safe behavior scores) with increasing age is clear from the graph. It is also clear that, at the 3-month and 1-year follow-up calls (broken and dotted lines), reported behavior has become safer for all groups, except for the 13-year-old non-participant group, which shows virtually no change across the three surveys. By contrast, safety day participants at all ages, including 13-year-olds, improve considerably in their reports of safe behaviors. Differences between pre-test and follow-up scores are statistically significant for all groups except the non-participant 13-year-olds.

Injuries

At each time point, the children were asked if they had received any injuries in the previous three months that required a trip to a doctor or hospital or caused them to miss at least part of a day's activities. The self-reported injuries are presented in table 9. In a repeated measures analysis of variance with time and participant/non-participant as factors, the main effect for time was significant ($F(2,2064) = 6.53$, $p = 0.001$), and the interaction of time × participant/non-participant was marginally sig-

Table 6. Behavior scores by event type, participant status, and farm residence.

			Safety Day Participants		Non-Participants	
	Time Factor	Event Type	Mean	SD	Mean	SD
Live on farm	Pre-test	Community	59.1	14.6	63.0	12.7
		School	55.8	15.8	60.2	14.7
	3-month follow-up	Community	66.9	14.1	66.4	14.3
		School	68.2	14.4	66.0	16.0
	1-year follow-up	Community	67.9	14.7	65.8	13.9
		School	67.6	15.4	64.3	14.4
Do not live on farm	Pre-test	Community	66.5	13.8	71.4	13.9
		School	65.9	14.6	71.7	15.3
	3-month follow-up	Community	76.6	13.6	76.7	12.8
		School	77.4	12.9	76.6	12.7
	1-year follow-up	Community	75.9	14.0	76.4	13.1
		School	77.1	13.5	77.9	14.1

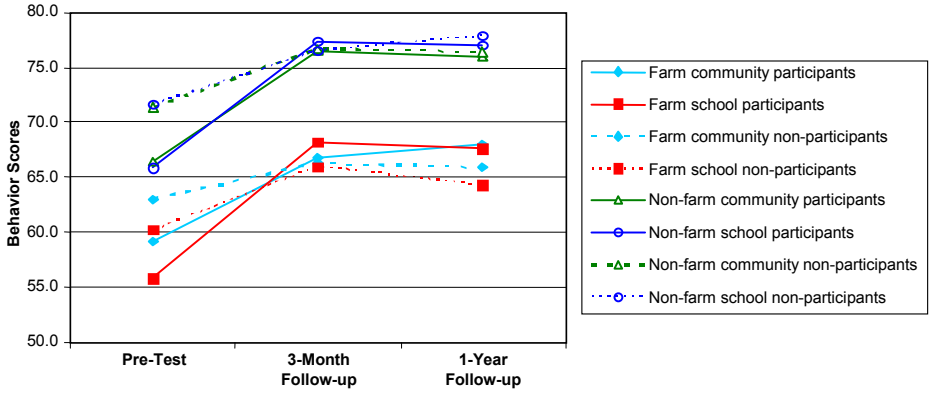

Figure 3. Safe behavior.

Table 7. Repeated measures analysis of covariance on behavior scores.

	F	df	Sig.
Age	26.02	1	0.000
Time	5.19	2	0.006
Time × Age	0.92	2	0.399
Participant/Non-participant	2.94	1	0.086
Event type	0.02	1	0.878
Farm residence	133.46	1	0.000
Time × Participant/Non-participant	21.25	2	0.000
Time × Event type	2.46	2	0.086
Time × Farm residence	0.56	2	0.573
Participant/Non-participant × Event type	0.18	1	0.670
Participant/Non-participant × Farm residence	0.98	1	0.324
Event type × Farm residence	1.32	1	0.252
Time × Participant/Non-participant × Event type	0.45	2	0.639
Time × Participant/Non-participant × Farm residence	0.80	2	0.450
Time × Event type × Farm residence	1.32	2	0.267
Participant/Non-participant × Event type × Farm residence	0.01	1	0.940
Time × Participant/Non-participant × Event type × Farm residence	0.04	2	0.961

Table 8. Behavior scores for participant × time interaction.

Time Factor	Safety Day Participants	Non-Participants
Pre-test	61.6	66.9
3-month follow-up	72.1	71.7
1-year follow-up	71.9	71.4

nificant ($F(2,2064) = 2.33$, $p = 0.097$). The participant/non-participant main effect was not statistically significant ($F(1,1032) = 0.38$). For the safety day participants, injuries decreased significantly from the pre-test to the 3-month follow-up and then increased significantly from the 3-month to the 1-year follow-up. For the non-participants, there were no significant differences among the injury rates.

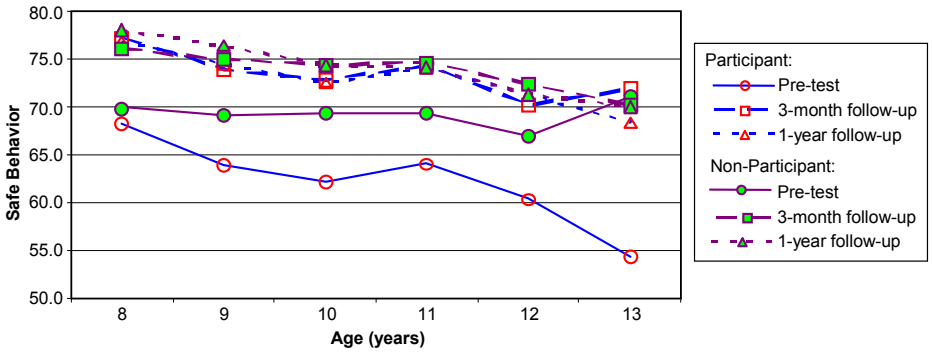

Figure 4. Safe behavior by age.

Table 9. Percent experiencing an injury in the past three months.

Time Factor	Safety Day Participants	Non-Participants	Total
Pre-test	15.6	13.3	14.7
3-month follow-up	8.4	10.9	9.4
1-year follow-up	12.9	10.2	11.8

Discussion

These results show that safety day participants gained important knowledge and information about safe behaviors between the time of the pre-test prior to the safety day and the follow-up interviews. Furthermore, they retained the knowledge and reported changes in behavior up to a year after their safety day participation, and the increases were evident at all age levels from 8 to 13. There is also preliminary evidence that injuries decreased for the participants, at least in the three months following the safety day. The findings contribute to a growing body of research supporting claims for the effectiveness of farm safety day programs for increasing knowledge and improving safe practices among the children who participate. It should be noted, however, that the changes seen in knowledge and behavior are rather small. The participants improved their knowledge scores and behavior scores by 10% to 15%, which represents answering one or two additional items correctly or answering in the safer direction on a couple of items. This degree of change replicates improvements documented in previous evaluations (McCallum et al., 2002; McCallum et al., 2005). Although small, these changes are statistically reliable and very robust, occurring across all age groups and event types. It is possible that more discriminating pre-tests and/or other behavioral response alternatives might reveal larger changes in knowledge and behavior.

Because improvements were also seen in the non-participant comparison group, some portion of the improvements observed may be a result of repeated testing, maturation, or other extraneous effects. Nevertheless, the changes in the participants were somewhat larger than those in the non-participants, and thus, it appears that the safety day event does have a modest independent effect on safety awareness over and above the possible effects found through multiple testing in the comparison groups. As with the effects across time, these differences are small, representing one or two additional items answered correctly or with the safer alternative, but they are reliable. Replication of this study with strong comparison groups may be necessary before determining with greater certainty the impact of this one-time educational intervention. Even with

these limitations, however, the relatively low-cost farm safety day program appears to have a positive effect on teaching safety to children.

In both groups, farm residence had a significant impact on baseline and follow-up responses. Those who lived on farms tended to have higher knowledge scores and lower behavior scores compared to those who did not live on a farm. Because of their greater exposure to some of the risks addressed at the safety day and in the evaluation, they arrive at the safety day knowing more, but being more likely to have the opportunity to engage in some of the risky behaviors. A reduction in risk exposure (increase in safety scores) for this group is particularly important.

Numerous investigations of injuries to children and youths living and working on farms cite the need for continuing educational efforts that reinforce safe behaviors, such as the use of personal protective equipment and safely equipped farm machinery (Reed et al., 2006) and the use of helmets and age-appropriate ATVs (Goldcamp et al., 2006). There is also a need to provide safety-related support and education to parents (Doty and Marlenga, 2006). The current investigation shows that there are increases in reported use of personal protective equipment and reductions in exposure to hazards following attendance at a farm safety day. Thus, these events can be one method for reinforcing safe behaviors and supporting parents' efforts. In addition, these events provide safety information and reinforcement back to parents, as the participants return home with messages they have heard and materials they have received (McCallum et al., 2006).

In a large survey of national FFA members, Westaby and Lee (2003) found that safety consciousness was negatively related to injury, which led the authors to suggest that a variety of approaches may be needed to continually heighten youths' consciousness of safety issues. Formats such as health and safety classes, public media, social pressure, and informal communications might all be beneficial in activating or priming safety consciousness, and thus help dissuade youths from choosing risky behaviors. Conway et al. (2007) also suggest the utilization of farm safety materials and questions by primary healthcare practitioners as an avenue to help promote safety consciousness. If engendered by a wide array of strategies, heightened safety consciousness is likely to generalize beyond the specifics of any particular message and translate to a broad sense of safety vigilance. Indeed, Reed et al. (2003) found that safety-related changes extended beyond and were more general than the specific safety instruction students received in a safety training class. Similarly, McCallum et al. (2002) noted that knowledge and behavior changes go beyond material presented in a particular safety day curriculum and tend to generalize to other safety issues. A safety day event, therefore, can serve both a priming role and a reinforcing role, raising general safety awareness, reminding participants of previously heard safety messages, leading to continued conversations at home and with friends following the safety day, and increasing the salience of safety messages that exist throughout the environment.

The idea of priming or increased safety consciousness might also help explain some of the positive effects seen for the comparison group in this study. Perhaps the process of taking the pre-test survey has a priming effect on safety awareness, which leads these non-participants to also notice more safety messages, perhaps ask questions of their parents or friends, or look for safety information in the environment. Without the specifics and context of the safety day, maybe they do not improve as much as the participants, but they do improve their safety consciousness enough to show some significant effects.

Although there is a body of data citing the effects of farm safety day programs and other safety education programs, there also are some studies that have shown no effects. For example, Lee et al. (2004) evaluated a national FFA safety education program and found that implementation was inconsistent and the desired outcomes were not achieved. In fact, there were no significant differences among the standard, enhanced, and control groups in self-reported learning, attitudes, or injuries. Additionally, the FFA advisers reported that time constraints limited their ability to implement the program adequately. Because educational programs such as these do not always produce the desired or intended outcomes, Kidd et al. (2003) suggested that it might be helpful to consider the readiness of a person to adopt new behaviors, as conceptualized in the Transtheoretical Model of Change (TMC; Prochaska et al., 1998). This model, which has proven useful in addressing cessation of unhealthy behaviors as well as acquisition of positive health behaviors, assumes that behavior modification is a process involving increments of change and that various interventions are effective at different points or stages within the process. As suggested by Kidd et al. (2003), the use of TMC could help determine patterns of response in relation to timing, dosing, and specific content of farm safety interventions. Tailoring interventions to various stages of change could prevent discarding potentially effective safety interventions that initially yield nonsignificant effects.

There are several limitations in the current study that prevent a definitive conclusion regarding the impact of safety days on children's attitudes, behaviors, and injuries. Reliance on self-report of behaviors, rather than actual observation, is a limitation of a study of this nature. Parental reports may be no more accurate than the child's report, as parents do not always know what their children are doing. More valid observation of behavior would be feasible only in a very limited study. The injury data may also suffer from being self-reports. The rates in this sample (12% over three months) are very high compared to national rates of injury for children in this age group, on or off farms. However, since they are measured over a shorter time period, they may include very minor injuries that tend to be forgotten or omitted from annual surveys and are excluded from injury rates based on emergency room reports. Still, the absence of more accurate and detailed injury data leads to an inability to address the injury issue more clearly. Another measurement limitation comes from the fact that the pre- and post-tests are brief (for reasons of practicality and respondent burden). Because of this, they cover a limited number of topics, and within those topics, only a very limited number of behaviors and facts. Given the local control over topics to be covered, not all participants received instruction in all areas. Thus, the pre- and post-tests cover some material that some of the children would not have heard at their safety day, and likewise, they would have heard a lot of information that was not covered in the pre- and post-tests. These are, therefore, a very imperfect measure of the pre- and post-safety day knowledge and behaviors of the children.

This study may be the best attempt so far at a true comparison group in a large-scale study of safety day programs, but it is far from ideal. The comparison groups are not perfectly matched to the participant groups, although great efforts were made to do so. In each safety day community, recruitment of the comparison group was difficult, and they are quite varied (e.g., some were intact classrooms, others were local clubs or other children's groups, some were recruited through random-digit dialing); however, the safety days themselves are also quite varied. The robustness of the effects may be more surprising in light of the variability in the safety days and the comparison

groups. There were some unexpected differences, however, between the safety day participants and the comparisons at the outset – the comparisons were slightly older, less likely to live on a farm, and had safer behaviors (or less risk exposure). The first two differences were handled as part of the analysis; but the latter difference, in particular, makes it difficult to interpret the changes. Although the safety day participants made clear improvements in safe behavior, and their improvements were larger than those of the non-participants, this brought them up to a final level that was only a little higher than the non-participants. A closer look at individual behaviors might help to reveal the sources or patterns of change for both groups. As noted previously, it is difficult to explain why the comparisons changed as much as they did. For changes in knowledge scores, maturation may be the most obvious explanation. As children increase in age, they know more, or they are better able to determine the correct answers, as these are not difficult questions. For behavior, on the other hand, a developmental shift toward greater risk would be expected; thus, the trend toward less risk over the year's time is even more unexpected. Additional research is needed to address this question.

A final limitation concerns the intervention itself. The safety days evaluated in this study are one-day events with brief exposure to a variety of safety topics, and there are many other intervening events and variables that are related to children's safety. It may not be reasonable to expect this one-day event to have large effects; but as part of an overall safety strategy for a community, it appears to have some added value.

Conclusion

Farm safety days are very popular events in hundreds of rural communities, and they have value to families and communities far beyond the direct safety information imparted to the young participants (McCallum et al., 2006). Because they are developed by local community leaders, the safety days address issues of local relevance and utilize the people most trusted by farm parents, i.e., extension agents and other local groups and individuals familiar to the community and known for disseminating safety information (Neufeld and Cinnamon, 2004). The safety days are overwhelmingly supported by parents and receive very positive ratings from children and parents alike (Arnold et al., 2006; McCallum et al., 2002; McCallum et al., 2006).

Many farm parents are aware of the risks their children face. Zentner et al. (2005) reported that 66% of farm parents perceive farm work as more dangerous for their children than other types of work, and 43% perceive that children living on a farm are more at risk for injury than children living in other settings. They also found, however, that parents believe the benefits of farm work for children tend to outweigh the risks of such work, and they believe strongly in the value of children being raised on a farm. Therefore, parents need all the assistance and support they can get from the surrounding community to help keep their children safe while allowing them to experience the benefits of farm living. Safety days provide one avenue for such support.

Although farm living and farm work are dangerous, there is good news regarding injuries to youths on farms. The number and rates of injuries have been decreasing over the past decade (Hendricks, 2008; National Children's Center for Rural and Agricultural Health and Safety, 2008). From 1998 to 2006, there has been a steady decline in injury rates for youth living on farms, from 19.2 per 1,000 household youth in 1998 to 10.4 per 1,000 household youth in 2006 (Hendricks, 2008). There were statistically

significant decreases for male youth as a whole and for all youth under 10 years of age. There have also been declines (although not reaching statistical significance) in all other age/gender groups as well, except for females, 16 to 19 years old, where rates have, unfortunately, increased. When considering all farm injuries to youth (including those who visit or are hired for work, as well as household youth), there are similar declines from 16.6 per 1,000 farms in 1998 to 10.5 per 1,000 farms in 2006. Although it may be difficult to pinpoint any single reason for declining injury rates, perhaps the safety messages are working. The overall trends are very encouraging. The number of farm safety days and other similar safety events targeting children and youth has increased dramatically since the mid-1990s, and this increased focus and emphasis on safety for children and youth on farms has been accompanied by a steady, significant decline in injuries.

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