Agricultural Safety and Health Best Management Practices
Program Number: 5 R01 CCR314471

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Final Performance Report

April 25, 2001

1. Final Performance Report

Abstract

This project uniquely combined two familiar agricultural practices—audits and best management practices (BMPs)—to address farm work hazards and hazard control. Audits and BMPs were combined in the *Agricultural Safety and Health Best Management Practices (ASHBMP) Manual*, which was developed at Penn State. The investigators sought to determine if the ASHBMP Manual was an effective educational and auditing tool via the following objectives: determine the interrater reliability and internal consistency of the ASHBMP Manual as an auditing tool; determine the effectiveness of the ASHBMP Manual with the target audiences; and determine the efficacy of using the visually-oriented ASHBMP Manual as a hazard audit tool for reducing hazards on farms. The interrater reliability for the ASHBMP Manual when evaluated by 21 insurance company representatives had high levels of concordance when compared to each other's results and when the group was compared to the ASHBMP Manual developers. Similar results were found when agricultural educators were tested for internal consistency. The target audiences—insurance company representatives, farmers, and agricultural educators—where asked questions to see if they thought the ASHBMP Manual had internal consistency and was an effective tool for farmers to use to reduce farm hazard levels. All groups thought the manual did have good internal consistency. They also agreed that farmers would find the ASHBMP Manual to be an effective tool in reducing farm hazard levels. A modified pretest-posttest control group design was used to test the effectiveness of the ASHBMP Manual on 145 randomly selected Pennsylvania farms. Testing included baseline and post-intervention hazard audits using three intervention groups and one control. The post-intervention audit occurred not less than 90 days after the baseline audit. Analysis of the data showed there was a significant decrease in farm hazard levels when farmers received a copy of the ASHBMP Manual over those farmers who did not receive a copy of the manual. There was also a positive significant difference among farmers who used the ASHBMP Manual over farmers who received the control (traditional safety fact sheets). In conclusion, the data the supports the hypothesis that the ASHBMP Manual is an effective tool for helping farmers to reduce farm hazards levels.

Significant Findings

Interrater Reliability

There were two groups of professionals who participated in the interrater reliability study. The first group consisted of twenty insurance company representatives (representatives) and the second group included nineteen agricultural educators (educators). Using the ASHBMP Manual as an auditing tool, both groups evaluated pre-selected tractors, PTO-powered machines, and buildings/structures. As the evaluations for the representatives and educators occurred at different times and locations, the tractors, machines and buildings structures were different between groups. The data collected from the representatives resulted in a Kendall's ω of 0.75 ($\chi^2_{df=10} = 145.0$,

$\alpha \leq .001$). Kendall's ω is a measure of concordance with an output that ranges between 0 and 1. The comparison between insurance company representatives and the ASHBMP Manual developers resulted in a Cronbach's α of 0.82 ($p \leq .002$).

The educators' data resulted in a Kendall's ω of 0.623 ($\chi^2_{df=11} = 137.0$, $\alpha \leq .001$). The comparison between insurance company representatives and the ASHBMP Manual developers resulted in a Cronbach's α of 0.87 ($p \leq .001$).

Internal Consistency

In addition to the representatives and educators, data was also collected from 79 of the farm operators who participated in the efficacy study. The efficacy study will be described later in this document. All three groups completed a survey that asked demographic questions and questions pertaining to the ASHBMP Manual. Some questions varied from group to group as not all of the questions would be pertinent for all groups.

Of the twenty-one representatives who completed the survey, 81% were male and 19% were female. The representatives ranged in age from 23 to 65 years old. Education levels ranged from grade school to college degrees. Insurance experience levels were between 6 weeks and 37 years. The representatives thought the ASHBMP Manual was at least a "Very Useful" (Cronbach's $\alpha = 0.71$, $\bar{x} = 1.68$) tool for farmers to use for reducing hazard levels. A 5-point Likert Scale was used with a one (1) corresponding to "Extremely Useful", a two (2) "Very Useful", a three (3) "Moderately Useful", a four (4) "Not Too Useful", and a five (5) "Not Useful At All".

Of the nineteen educators who completed the survey, 78% were male and 22% were female. The educators ranged from 29 to 64 years old. All educators had taken at least some college coursework. Educator experience in agricultural settings varied from 1 day to 38 years. The educators, similarly, thought the ASHBMP Manual was at least a "Very Useful" (Cronbach's $\alpha = 0.89$, $\bar{x} = 1.70$) tool for farmers to use for reducing hazard levels.

The farm operators who completed the survey consisted of 96.2% males and 3.8% females, and had a mean age of 49.4 years. Education levels of the farm operators represented in the survey ranged from high school diplomas to college graduates. The farm operators thought the ASHBMP Manual was at least a "Very Useful" (Cronbach's $\alpha = 0.86$, $\bar{x} = 1.97$) tool for other farmers to use in hazard level reduction activities.

Readability was an aspect of the ASHBMP Manual used to further determine its internal consistency. As photographs and other graphics are used to augment the text in the ASHBMP Manual, the manual does not always use complete sentences. The readability test that does not rely on complete sentence structure is the FORCAST Formula. This test was designed by the military to evaluate manuals, which often do not use complete sentences. The ASHBMP Manual had a FORCAST reading level of Grade 11.0. The

manual was designed to be read by high school graduates. There is no method to evaluate the effect that photographs and graphics have on overall readability levels.

Efficacy

Of the 150 farms and farm operators that started the study, 145 completed all aspects of the efficacy study. The farm sample was randomly selected from the population of agriculturally insured farm owners from the Old Guard Insurance Group. Old Guard is the largest agricultural insurer in Pennsylvania. Within the sample 79 (54.5%) farm operators completed a survey. Some of this information from the survey has already been presented. Other demographic information provided from the survey includes the following:

1.	Farm size:	20 to 2000 acres ($\bar{x}$ = 346.5 acres)
2.	Farm operation size classification:	medium or larger (as defined by the US Department of Commerce)
3.	Farm operator age:	26 to 81 years old
4.	Farm operator experience level:	4 to 62 years ($\bar{x}$ = 32.6 years)
5.	Off farm employment:	20.8% had regular employment
6.	Farm operator's safety analysis of their farm:	91% thought their farm was a least moderately safe 3% thought their farm was moderately unsafe 0% thought their farm was unsafe

The modified pretest-posttest control group design was used to determine the efficacy of the ASHBMP Manual. The participants in the study were randomly selected to receive one of four treatments.

Treatment 1:	a copy of the ASHBMP Manual and a copy of the results of the baseline hazard audit.
Treatment 2:	a copy of the ASHBMP Manual, only.
Treatment 3:	a copy of the results of the baseline hazard audit, only.
Treatment 4:	control measure of providing a compilation of extension safety fact sheets.

There was no interaction ($F_{3, 1054} = 2.204$, $p \leq .0.086$) found between all four treatments. But when a graph of this test was looked at and the fact that the p-value was very close to the 0.05 significance level, it was noted that there was a clear difference between those farmer who receive a copy of the ASHBMP Manual and those who did not. Therefore, more testing was warranted. It was found that farmers who received a copy of the ASHBMP Manual had a significant reduction ($F_{1, 1056} = 6.454$, $p \leq .0.011$) in farm hazard levels over farmers who did not receive a copy of the ASHBMP Manual. Analysis showed a significant reduction ($F_{1, 510} = 4.444$, $p \leq .0.036$) of hazard levels when only the ASHBMP Manual was given to farmers verses the farmers who received only the results of the hazard audit. Further analysis also showed that if farmers received a copy of the ASHBMP Manual, they would have significantly reduced ($F_{1, 502} = 4.088$, $p \leq .0.044$)

hazard levels as opposed to farmer who received the safety fact sheets (control).

Usefulness of the Findings

The findings are useful as there was a significant reduction of farm hazard levels whenever the ASHBMP Manual was used. The findings also showed that the three audiences—farmers, insurance company representatives, and agricultural educators—of the ASHBMP Manual thought the manual was useful not only to the individual audiences but to farmers as a tool to use for hazard reduction activities. The ASHBMP Manual was developed as an alternative tool to be used by farm operators, the insurance industry, and agricultural educators to reduce farm work hazards. It appears, after analysis of this initial study, the ASHBMP Manual has promise as an effective and useful tool for the reduction of farm hazard levels.

List of Publications

Legault, M. L. and D. J. Murphy. 2000. Evaluation of the agricultural safety and health best management practices manual. *Journal of Agricultural Safety and Health* 6(2): 141-153.

Legault, M. L. and D. J. Murphy. 2000. Reliability and internal consistency testing of the agricultural safety and health best management practices manual. "Agricultural Safety & Health in a New Century: Programs and Abstracts". April 28-30, Cooperstown, New York. (p. 131).

Legault, M. L. 1999. Using a handheld personal computer to collect agricultural hazard audit data. American Society of Agricultural Engineers International Meeting, July 19-21, Toronto, Ontario. Technical Paper No. 99-7044.

Legault, M. L. and D. J. Murphy. 1999. Reducing farm work hazards with agricultural safety and health best management practices. National Institute for Farm Safety Summer Meeting, June 20-24, Ocean City, Maryland. Technical Paper No. 99-14.

Legault, M. L. and D. J. Murphy. 1998. Evaluating an agricultural safety and health best management practices manual. Fourth International Symposium "Rural Health and Safety in a Changing World: Book of Abstracts". October 18-22, Saskatoon, Saskatchewan. (P173).

Explanation of How the Publications Relate to the Project Aims

The ASHBMP Manual publications show that the project aims were met. The objectives for this study were to:

1) Determine the interrater reliability and internal consistency of the ASHBMP Manual as an auditing tool for use by the insurance industry;
2) Determine the efficacy of using the visually-oriented ASHBMP Manual as a hazard audit tool for reducing hazards on farms; and

3) Determine the effectiveness of the ASHBMP Manual with the target audiences by tracking usage through a survey instrument.

The significant results, described above and presented in the publications derived from this study, showed that the ASHBMP Manual had at least good interrater reliability and internal consistency as an auditing tool for use by the insurance industry. The results showed the ASHBMP Manual to be an effective tool for reducing farm hazard levels. As an auditing tool, the results also showed that if an outside auditor presented the results to a farmer, then a copy of the ASHBMP Manual would have to be provided to the farmer to achieve a significant reduction in hazard levels. Therefore it can be said that the visually oriented ASHBMP Manual is an effective hazard reduction tool for farms. The insurance industry representatives and the agricultural educators were trained how to use the ASHBMP Manual effectively as an auditing tool. Farmers were not trained, but the efficacy study showed that they did use the ASHBMP Manual to effectively reduce farm hazard levels. All three target audiences were asked to complete a survey after being trained to use or were exposed to the ASHBMP Manual. The publications showed that the ASHBMP Manual was thought to be a useful and easily understood hazard reduction tool for farmers to use.

2. Financial Status Report

Penn State University's Research Accounting Office files all financial status reports.

3. Equipment Inventory

No major equipment, as specified by 45 CFR Part 92, was purchased under this grant.

4. Final Invention Statement

No inventions were conceived under this grant.

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service
Centers for Disease Control
and Prevention (CDC)

Memorandum

Date: May 23, 2001

From: Roy M. Fleming, Sc.D., Director, Research Grants Program RMF
Office of Extramural Programs, NIOSH, D30

Subject: Final Report Submitted for Entry into NTIS for Grant 5 R01 CC314471-03.

To: William D. Bennett
Data Systems Team, Information Resources Branch, EID, NIOSH, P03/C18

The attached final report has been received from the principal investigator on the subject NIOSH grant. If this document is forwarded to the National Technical Information Service, please let us know when a document number is known so that we can inform anyone who inquires about this final report.

Any publications that are included with this report are highlighted on the list below.

Attachment
cc: Sherri Diana, EID, P03/C13

List of Publications

Legault ML, Murphy DJ: Evaluation of the Agricultural Safety and Health Best Management Practices Manual. Journal of Agricultural Safety and Health 6(2): 141-153, 2000

Title:	Agricultural Safety and Health Best Management Practices
Investigator:	Dennis J. Murphy, Ph.D.
Affiliation:	Pennsylvania State University
City & State:	Universtiy Park, PA
Telephone:	(814) 865-1372
Award Number:	5 R01 CC314471-03
Start & End Date:	3/1/1998–1/28/2001
Total Project Cost:	$324,942
Program Area:	Intervention Effectiveness Research Methods
Key Words:	intervention, agriculture, traumatic injuries

Abstract:
This project uniquely combined two familiar agricultural practices—audits and best management practices (BMPs)—to address farm work hazards and hazard control. Audits and BMPs were combined in the Agricultural Safety and Health Best Management Practices (ASHBMP) Manual, which was developed at Penn State. The investigators sought to determine if the ASHBMP Manual was an effective educational and auditing tool via the following objectives: determine the interrater reliability and internal consistency of the ASHBMP Manual as an auditing tool; determine the effectiveness of the ASHBMP Manual with the target audiences; and determine the efficacy of using the visually-oriented ASHBMP Manual as a hazard audit tool for reducing hazards on farms. The interrater reliability for the ASHBMP Manual when evaluated by 21 insurance company representatives had high levels of concordance when compared to each other's results and when the group was compared to the ASHBMP Manual developers. Similar results were found when agricultural educators were tested for internal consistency. The target audiences—insurance company representatives, farmers, and agricultural educators—where asked questions to see if they thought the ASHBMP Manual had internal consistency and was an effective tool for farmers to use to reduce farm hazard levels. All groups thought the manual did have good internal consistency. They also agreed that farmers would find the ASHBMP Manual to be an effective tool in reducing farm hazard levels. A modified pretest-posttest control group design was used to test the effectiveness of the ASHBMP Manual on 145 randomly selected Pennsylvania farms. Testing included baseline and post-intervention hazard audits using three intervention groups and one control. The post-intervention audit occurred not less than 90 days after the baseline audit. Analysis of the data showed there was a significant decrease in farm hazard levels when farmers received a copy of the ASHBMP Manual over those farmers who did not receive a copy of the manual. There was also a positive significant difference among farmers who used the ASHBMP Manual over farmers who received the control (traditional safety fact sheets). In conclusion, the data the supports the hypothesis that the ASHBMP Manual is an effective tool for helping farmers to reduce farm hazards levels.

Publications
Legault ML, Murphy DJ: Evaluation of the Agricultural Safety and Health Best Management Practices Manual. Journal of Agricultural Safety and Health 6(2): 141-153, 2000