

Safety Awareness at IRAD
State of Washington
Department of Labor and Industries
WISHA Grant No.00W-174

Irwin Research and Development, Inc.
Project Manager: David Feriante, Safety Officer
with
Prevention MD
David L. Wood, MD, MPH

July 2000 – June 2001

Safety Awareness at IRAD

David L. Wood, MD, MPH, David Feriante, Safety Officer, Project Manager

Abstract

Background. A little over a year ago IRAD was introduced to a safety program called SafeStart which appeared to present a unique approach to injury reduction. The Department of Washington Labor and Industries WISHA Grant Program provided us with the opportunity to purchase the program and implement it within the workplace. We selected the portion of our workforce among whom we had the greatest number of accidents in previous years to be the recipients of the program.

Objectives. We undertook the study to determine whether or not the SafeStart safety program would increase our worker's awareness of 'at risk' habits and behaviors and subsequently decrease the number of accidents among those workers.

Materials. SafeStart is a training program that utilizes five modules with a 10-15 minute video and a workbook for each module. The program seeks to help individuals become aware of four key states of mind that lead to four critical errors.

Methods. Prior to the beginning of the program we gave a questionnaire concerning safety awareness, actions and attitudes we introduced the program at a rate of one module per month. Employees would first see the SafeStart video for the module and were then provided with a workbook and an answer sheet. Each week they would complete one of four pre-determined sections of the workbook. This method was followed for the first two workbooks. At that time, it was determined to allow individuals to complete the last three workbooks at their own pace as they were introduced. The initial questionnaire was given again immediately after and three months following the program.

Results. Participation rates remained high throughout the course of the program. We had a greater than 90% return on all worksheets, with 98.9% of remaining employees completing the final questionnaire. The pre and post questionnaire responses demonstrated a significant improvement in all three areas with an insignificant drop over the three months following the program: Awareness (mean, 24.1 vs 27.4 vs 27.8, $p<0.001$, $p=NS$), Actions (mean, 27.1 vs 29.3 vs 28.6, $p<0.002$, $p=NS$), Attitudes (mean, 14.4 vs 15.2 vs 15.2), $p<0.001$, $p=NS$). The numbers for reportable injuries for the last three years were not large enough to do a meaningful statistical analysis.

Conclusions. The SafeStart program significantly improved our workers' awareness, actions and attitudes concerning healthy safety habits and risks.

Introduction

Irwin Research and Development, Inc. became aware of the SafeStart program a little over a year ago. The State of Washington, Labor and Industries WISHA Grant Program provided us with the opportunity to evaluate the program with a portion of our workforce. After evaluating our injury report forms and identifying which portion of our workforce accounted for the greatest number of injuries in a year's time, we selected our J-2 worksite, the machine shop, as the best location for testing the effectiveness of the program. The machine shop, which represents 40% of the workforce, consistently accounted for >60% of the reportable injuries. We felt that we would obtain the greatest benefit from the initial trial of the program within this population. Most of the injuries in the machine shop are hand and wrist injuries due to the type of work that is done there. The SafeStart program should optimally benefit this type of work environment.

Materials and Methods

Materials

SafeStart is an additional way to think about safety. It is not about telling a person what to do, nor is it designed to replace sound engineering, good management practices, or specific training on workplace hazards. It is *learning to keep those hazards in mind and in sight* on-the-job, off the job and on the highway. It is about changing unintentional and habitual behaviors that can lead to injury. The program identifies four states that can contribute to making four critical errors that increase the risk of injury. These states are rushing, frustration, fatigue and complacency which lead to the critical errors of eyes not on task, mind not on task, moving into the line-of-fire, or losing one's balance, traction, or grip. The course materials include a Leader's Guide, Five Self-Study Workbooks, Five Videotapes, SafeStart Definition cards, SafeStart Techniques cards, Posters, and Completion Certificates. The five unit workbooks are 1) Introduction and Overview, 2) Eyes on Task, Mind on Task, 3) Line-of-Fire, Balance/Traction/Grip, 4) Rushing, Frustration, Fatigue, Complacency, and 5) Putting It All Together (Summary). The summary encourages the worker to practice Critical Error Reduction Techniques (CERT). These include 1) self-triggering on the state(or amount of hazardous energy) so that you don't make a critical error, 2) analysing close calls and small errors (to prevent agonizing over big ones), 3) looking at others for the patterns that increase the risk of injury, and 4) working on habits.

The SafeStart Technique cards encourage workers to look for situations where either rushing, frustration, fatigue or complacency lead to one of the critical errors of eyes not on task, mind not on task, moving into the line-of-fire, or losing one's balance, traction or grip. Once identified, they are to note whether it was caused by themselves or another person, what the injury potential was (serious, minor, first aid, minimal), and then apply critical error reduction techniques. The tapes and workbooks are repetitive in their approach, reinforcing the concepts over and over again in various situations. The goal is to help workers to become aware of unintentional behaviors that can put them at risk for injury and to help them to change bad habits that they identify that can be harmful.

Additionally, we developed a questionnaire (Appendix A) that was to be given prior to the program, immediately following the program, 3 months following the program, and 6 months following the program. (Due to the time constraints, we were only able to complete the first three administrations of the questionnaire.) The questionnaire was designed to identify awareness, actions and attitudes relating to the material covered by the program. The first section sought to identify how important each worker considered the four states and the four critical behaviors to be in the causation of accidents. The second section sought to identify with what frequency each worker employed critical error reduction techniques. The third section sought to identify whether or not workers agreed with certain right and/or wrong attitudes concerning why accidents happen.

Study Design

We began the program with the administration of the questionnaire. Following the questionnaire, workers watched the first video. They were then instructed to complete the first workbook over the next month. Assignments were given weekly covering one fourth of the material in the workbook and collected by the shift supervisors at the end of the week. Each subsequent workbook was introduced at a safety meeting during which the next video was shown, concepts were discussed, and the new workbook was assigned. The first two workbooks were managed in the same manner. We took a two to three week break over the Christmas/New Year holiday period. Following the second workbook, we decided to allow the workers to complete each of the last three workbooks at their own rate without restricting the amount of material to be covered weekly. The turn around time for completion was 2 to 4 weeks. The monthly safety meetings were handled in the same manner. Following the completion of the program, we had another safety meeting during which we again administered the same questionnaire. This was repeated again three months later.

Data Analysis

Each worker was assigned a number for the program. Records were kept of the completion of all questionnaires and workbook assignments. Numbers of observations utilizing the technique cards were noted. Responses to each of the questionnaires were recorded. Attrition due to worker turnover was tracked. Participation rates were figured based upon the number of complete questionnaires or assignments that were turned in per number of active participants remaining in the study group.

The questionnaire results were analyzed using the paired t-test. Answers to each question were given numeric values from 1-5, with the lower numbers representing the least acceptable answer. The questions were grouped according to category: awareness, actions, or attitudes. An average was obtained for the totals for all of the questions in a category. The mean for all of the workers responses in a category was computed. The mean difference between the first and second questionnaires and the second and third questionnaire responses was determined. A *t-value* along with a 2-tailed probability was computed for each of the six comparisons.

Data concerning the number of injuries were obtained from OSHA Form 200. Yearly averages for numbers of employees were obtained from company records. Numbers of injuries per employee were figured based upon these numbers. No analysis was performed based upon the difficulty of arriving at a meaningful conclusion given the smallness of the comparison numbers.

Results

Participation rates for the program were excellent. The following table shows the number of active employees participating in a particular assignment and the number completing that assignment. No assignment had less than a 90% **completion**. The percentage of involved employees who were still employed at the end of the program and completed the final questionnaire was 98.9%.

Table 1: Employee assignment completion numbers.

	Q1	W1A	W1B	W1C	W1D	W2A	W2B	W2C	W2D	W3	W4	W5	Q2	Q3
Rec	122	125	125	119	118	118	119	115	107	109	106	106	106	92
Emp	122	125	125	124	124	122	122	119	118	115	114	112	108	93
%	100	100	100	96.0	95.2	96.7	97.5	96.6	90.7	94.8	93.0	94.6	98.1	98.9

* The Q stands for Questionnaire, the W for Workbook assignment. Units 1 & 2 were divided into 4 assignments. Rec stands for received, and Emp for the number of employees participating at that time.

The number of employees who completed at least one technique card identifying a potential risk situation was 69 or 56.6% of the original number of 122. The total number of observations made was 296.

Statistical analysis of the questionnaires was done only on those workers completing all three of the questionnaires. The total number of workers for whom questionnaires were evaluated was 87. The questionnaire was evaluated in three sections: Awareness, Actions, and Attitudes. Section 1 had 8 questions worth 5 points per question. Section 2 had 9 questions worth 5 points per question. Section 3 had 5 questions worth 4 points per question. There were 6 questions (8, 18-22) that were not included in the evaluation, none of which were relevant to the above-mentioned sections. The responses to those questions indicated either some confusion in the interpretation of the question or the response itself was ambiguous.

The following tables give the statistical data for comparisons between the first and the second questionnaires. Improvement in awareness, actions and attitudes as determined by the mean difference was significant with a p value of 0.001, 0.002, and 0.001, respectively. The mean difference between the second and the third questionnaires was not significant using the same method of analysis. (Awareness, 27.4 & 27.8, $p > 0.05$; Actions, 29.3 & 28.6, $p > 0.05$; Attitudes, 15.2 & 15.2, $p > 0.05$)

Table 2: Mean Difference in Awareness.

Paired samples t-test: Q1A & Q2A.					
Variable	Number of Cases	Mean	Standard Deviation	Standard Error	
Q1A	87	24.07	7.08	0.76	
Q2A	87	27.44	6.68	0.72	
Mean Difference	Standard Deviation	Standard Error	t value	Degrees of Freedom	2-Tailed Probability
3.37	8.64	0.93	3.42	86	0.001

Table 3: Mean Difference in Actions.

Paired samples t-test: Q1B & Q2B.					
Variable	Number of Cases	Mean	Standard Deviation	Standard Error	
Q1B	87	27.10	4.68	0.50	
Q2B	87	29.26	5.10	0.55	
Mean Difference	Standard Deviation	Standard Error	t value	Degrees of Freedom	2-Tailed Probability
2.16	6.06	0.65	3.33	86	0.002

Table 4: Mean Difference in Attitudes.

Paired samples t-test: Q1C & Q2C.					
Variable	Number of Cases	Mean	Standard Deviation	Standard Error	
Q1C	87	14.44	2.06	0.22	
Q2C	87	15.18	0.99	0.11	
Mean Difference	Standard Deviation	Standard Error	t value	Degrees of Freedom	2-Tailed Probability
0.71	1.96	0.21	3.38	86	0.001

Reportable injuries at IRAD had a significant drop three years ago when we instituted a required computer safety program for new employees. While the number of injuries per employee were lower in the first 6 months of 2001 than the previous two years, the change was not statistically significant ($p > 0.05$). However, the decrease in the number of lost time injuries was very significant when compared to the previous years, although this change was not restricted to the machine shop only.

Table 5: Injury Statistics.

	Employees	Reportable Injuries (J2%)	Percent	% Lost Time Injuries
1997	424	46 (69.0%)	10.8	43.8
1998	361	49 (67.3%)	13.6	44.1
1999	297	29 (60.0%)	9.8	31.8
2000	302	28 (58.6%)	9.3	33.3
2001	295	13 (6 mo.) (61.5%)	8.8	16.6

Discussion

The SafeStart Safety Program proved to be a beneficial project for the company in several ways. Our original performance targets included a 95% completion rate, a 75% assimilation of material, an 80% employee implementation, and a 50% reduction in reportable injuries. Our participation rate throughout the program remained above 90% and our completion rate was 98.9% of the employees who were still employed by the company at the end of the program. The reduction in employees came as a result of work slowdown following the holiday season. The employees responded well to the program and continue to interact with one another concerning the key concepts learned. If an employee has an injury or a near accident, they joke with him about whether or not they had his mind on the task, etc.

The program is designed to be done in a 5 week time period. We decided to spread it out over a 5 month time frame. This was done so as to prolong the exposure to the concepts and to allow the employees to work on the workbooks at their own pace. For control purposes we began the program collecting an assignment per week. Each workbook was divided into four sections so that the workbook would be completed in a month's time. The employee participation response was so high that for the last three workbooks we allowed the employees to proceed through the workbooks at their own pace during the month. Completion rates remained good. Determining how much of the material was assimilated and implemented is difficult to measure. As we noted above, 56.6% of the employees utilized the technique cards to record at least one situation where the principles of SafeStart could be applied. Generally, the comments at the meetings and the general interaction of the men at work would imply that the key concepts of four states (rushing, frustration, fatigue, and complacency) and four critical errors (eyes or mind not on task, moving into the line of fire, and losing one's balance, traction or grip) were well received and assimilated by the majority of those taking the class. Implementation can partially be determined by the use of the critical error reduction techniques identified by use of the technique cards. While the 56.6% does not approach the 80%, it may be presumed that some personalities would implement the practice while choosing not to report it on a card, for whatever reason.

The questionnaire results provide further support for the overall positive effect of the training program. The first section, that sought to identify how important each worker considered the four states and the four critical behaviors to be in the causation of accidents, reflects upon the workers acceptance of the key concepts presented. The increased value given to these concepts following the course was very significant. The second section, that sought to identify with what frequency each worker employed critical error reduction techniques, gives an indication of implementation. Again, the positive improvement in worker responses seems to indicate an increased implementation of these techniques. The improvement in the third section that sought to identify whether or not workers agreed with certain right and/or wrong attitudes concerning why accidents happen, seems to indicate an increased understanding of some general principles related to causes of injury. The statistical difference in the means was very significant in each of the sections. Furthermore, these improved scores were maintained three months after the program.

With regard to a reduction in the injuries of the workers taking the program, it is difficult at this point to make any firm conclusions. There was a slight drop in the 6 months averaged reportable number of injuries, but it was not significant. The reduction in lost time injuries was significantly reduced but this was true of the entire workforce and not just the machine shop. Also, the course was not completed until March so that the true post course period was only the last three months. The low injury numbers are at least supportive of a positive complement and reinforcement of the other safety measures and programs implemented at IRAD.

Overall, the SafeStart program seemed to provide the workers with a new way of looking at the whole concept of accidents and injuries. It increased awareness of the part that each individual can play to reduce accidents both in the workplace and away from the workplace. Yearly reviews of the material should be sufficient to help reinforce these training concepts along with occasional encouragement for workers to use the technique card system to identify potential problems. One of the workers was so impressed with the program that he was encouraged to take it to another company in town and present it to them. The continued sharing of the concepts of this program both within the company and with other companies will be encouraged.

Appendix A

SafeStart Questionnaire
Irwin Research and Development, Inc.
L&I Project 2000
Grant Contract No. OOW-174

1. Consider the following four conditions. After each one, indicate how often you believe that it is a major factor in accidents.

- a. **Rushing** (Exceeding the pace at, which you normally perform a task.)

Almost Never Seldom Occasionally Frequently Almost Always

- b. **Frustration** (Caused by relationships both inside and outside the workplace, i.e. malfunctioning equipment, personal differences, inadequate tools, conflicting objectives and pressures, etc.)

Almost Never Seldom Occasionally Frequently Almost Always

- c. **Fatigue** (Being too tired physically, or mentally to do the job safely.)

Almost Never Seldom Occasionally Frequently Almost Always

- d. **Complacency** (Being familiar enough with the hazards to become considerably less concerned over time.)

Almost Never Seldom Occasionally Frequently Almost Always

2. Consider the following four critical errors in not paying attention to the task we are doing. After each one, indicate how often you believe that it is a major factor in accidents.

- a. **Eyes not on Task** (Not looking where you are going or what is coming at you.)

Almost Never Seldom Occasionally Frequently Almost Always

- b. **Mind not on Task** (Not concentrating on the job, being unaware of dangers or deficiencies, forgetting things, making more errors than normal, going on 'auto-pilot', 'drifting away', etc.)

Almost Never Seldom Occasionally Frequently Almost Always

- c. **Line-of-Fire** (Not being conscious of where you are or where you are going in relation to the direction of the hazardous energy, i.e. stepping in front of a moving object, putting your hand between two moving parts, or touching a live wire.)

Almost Never Seldom Occasionally Frequently Almost Always

- d. **Balance/Traction/Grip** (Doing something that could cause you to lose your balance, traction or grip. It could include not wearing good footwear; gloves, not having a good grip in the first place or not seeing or thinking about the hazard.)

Almost Never Seldom Occasionally Frequently Almost Always

3. In the last month, how often do you recall recognizing that you were in a state that increased the risk of making a critical error (e.g. rushing, frustrated, tired, complacent) and making a conscious effort to do something about it before you made a mistake?

Almost Never Seldom Occasionally Frequently Almost Always

4. In the last month, how often do you recall recognizing that you were committing a critical error which could increase your chances of injury (e.g. not looking at what you were doing, not thinking about what you were doing, placing yourself in the line-of-fire of a potential hazardous source of energy, or not being certain of good balance, traction, or grip) and making a conscious effort to do something about it before you made a mistake?

Almost Never Seldom Occasionally Frequently Almost Always

5. In the last month, how often do you recall analysing a "close call" and trying to learn from it?

Almost Never Seldom Occasionally Frequently Almost Always

6. In the last month, how often do you recall observing others around you to look for actions that increase risk?

Almost Never Seldom Occasionally Frequently Almost Always

7. In the last month, how often have you made a conscious effort to work on your habits that may involve safety, like watching where you're walking, or getting your eyes back on the road faster?

Almost Never Seldom Occasionally Frequently Almost Always

8. How many times out of 10 would you deliberately do the following in potentially hazardous situations:

- a. Test your footing when you get out of the car, before you put any weight on it? _____
- b. Look before you rest your hand on something to support your weight? _____
- c. Move your eyes before you move your body or your car? _____
- d. Get your eyes back on the road almost immediately if you've been distracted by something? _____
- e. Look for line-of-fire potential before moving? _____
- f. Look for things that could cause you to lose your balance, traction or grip? _____
- g. Glance up before standing up (to avoid banging your head)? _____
- h. Keep your hands out of pinch points? _____
- i. Maintain three points of contact when you are climbing any kind of ladder or machine? _____
- j. Hold the handrail on stairways? _____

9. How often do you perform pre-job/task inspections when undertaking a task that has some measure of risk?
- Almost Never Seldom Occasionally Frequently Almost Always**
10. How often do you use visual aids (little signs, keeping personal protective equipment readily visible) to help you remember to think about safety before starting a job?
- Almost Never Seldom Occasionally Frequently Almost Always**
11. How often do you remind yourself to watch for potential danger in a situation (e.g. parked cars in a residential area?)
- Almost Never Seldom Occasionally Frequently Almost Always**
12. How often do you stop to consider the direction and force of a potential hazardous source of energy in relation to your body's position?
- Almost Never Seldom Occasionally Frequently Almost Always**

State whether you strongly agree, agree, disagree or strongly disagree with the following statements.

13. Some people are just accident-prone.
- Strongly Disagree Disagree Agree Strongly Agree**
14. Just 'happening to be in the wrong place at the wrong time' is largely responsible for most accidents.
- Strongly Disagree Disagree Agree Strongly Agree**
15. Making people aware of how errors increase risk is an important step in getting them to improve their habits and decisions related to safety.
- Strongly Disagree Disagree Agree Strongly Agree**
16. The majority of acute injuries could be prevented by just remembering to think about what could be coming at you (speed and force), what could cause you to lose your balance, traction or grip, or what might get in your way.
- Strongly Disagree Disagree Agree Strongly Agree**
17. People don't generally make mistakes deliberately, but they can make them habitually and/or unintentionally.
- Strongly Disagree Disagree Agree Strongly Agree**

State whether the following statements are true or false in your opinion.

18. For most people, the number one way they 'could have died accidentally' is by falling asleep at the wheel.
- True False**
19. In terms of short term or acute injuries in industry, slips and falls is the #1 cause of lost time accidents.
- True False**

20. Which of the following actions, which commonly lead to accidents, is the most likely to be a deliberate act (taken because the person believes he/she will not be injured)?
- a. Not having one's eyes on the task.
 - b. Not having one's mind on the task.
 - c. Moving into the line-of-fire of some potential hazardous energy.
 - d. Losing one's balance, traction or grip.
21. In the last month, how many times can you recall having a close call, a minor injury, or a major injury (requiring medical care) while away from work?

Close Call Minor Injury Major Injury

22. In the last month, how many times can you recall having a close call, a minor injury, or a major injury while at work?

Close Call Minor Injury Major Injury

“Funding and support for this project has been provided by the State of Washington, Department of Labor and Industries, WISHA Safety and Health Grant Program.”