

**Evaluation of Ergonomics Training Workshops,
Washington State, 2001**

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Executive Summary:

Participants (n = 232) from around the State of Washington who attended a four-hour workshop on implementing the Washington State ergonomics rule completed pre and post workshop assessment questionnaires. Overall findings include a significant increase in the participants' perception of their ergonomics rule knowledge.

1. Participants' knowledge of the ergonomic rule and hazard reduction methods increased significantly
2. Those with no previous ergonomics training had greater increase in their knowledge than those with previous ergonomics training

Introduction

Ergonomics is the science and practice of designing jobs or workplaces to match capabilities and limitations of the human body. Knowledge of ergonomics helps both the employer and employee identify jobs and tasks such as lifting heavy loads, working in awkward postures, or performing certain repetitive motions over time that may lead to injury and work-related musculoskeletal disorders (WMSDs). It has been estimated that 40% of the world's work-related health costs are attributed to WMSDs both in developing and developed countries.¹ It has also been shown that ergonomic interventions have reduced the number of WMSDs by over 50%.^{2,3}

An ergonomics program should utilize intervention techniques that focus on a method of achieving prevention. Training should be part of any program aimed at improving work and the work environment.

In Washington State, 27 percent of workers' compensation claims paid by the Department of Labor and Industries involved WMSDs over the period between 1991 and 1999, with direct costs of \$2.4 billion. Good ergonomic design and education of employers and employees is one of major strategies to reduce the burden of WMSDs. The Labor and Industries' staff conducted training workshops on "Implementing Ergonomics for Employers" to assist employers in preparing to implement the ergonomics rule. The objectives of the workshop were to enable participants to:

- Identify and analyze caution zone jobs
- Identify and analyze work-related musculoskeletal disorder (WMSD) hazards
- Introduce ergonomics controls to their workplaces

Pre- and post- training evaluation sessions were conducted to assess the improvement of knowledge and skills among participants.

Methods:

The training workshops were conducted between July 24 and December 15, 2001. Each workshop was four hours in duration. Workshops were evaluated by means of questionnaires administered to the participants immediately prior to the training and immediately after the training. We used the before- and after- study design without a control group. The study design offers evidence about intervention effectiveness, particularly demonstrating the immediate impacts of short-term programs.⁴ We compared the proportion of participants with correct responses to the proportion of the participants with incorrect responses to the same set of questions administered both before and after training. Similarly, participants who thought they had 'some to good' ergonomics ability prior to the workshop were compared to participants who thought they had 'no' ergonomics ability before the training workshop and the two groups were compared after the training workshop. The following true/false questions were asked before and after the training workshop.

- A caution zone job does not need to be fixed to be in compliance with the rule?
- Under the ergonomics rule, a job is a hazard if an employee reports an injury?
- All jobs must be evaluated using the L& I Checklist of the ergonomics rule?

There was also one question aimed to assess participants' knowledge about ways to reduce lifting hazards. Each response was scored; One point was given for each correct administrative solution and two points were given for each correct engineering solution. When a correct pre-test answer was given but no post-test answer was given, the pre-test score was transferred to the post-test score therefore assigning zero points. The difference in mean score was evaluated using a paired t-test.

Participants were asked to assess themselves before and after training in the following four areas as having "no", "some", or "good" ability, using a five point Likert Scale.

- Ability to begin identifying and analyzing caution zone jobs.
- Ability to begin identifying and analyzing work-related WMSDs.
- Ability to identify the requirements for ergonomics awareness education.
- Ability to begin introducing ergonomics solutions into the workplace.

We collapsed the first two points as 'no ability' and the last three points as 'some-to good ability' and compared the proportion of participants having 'some- to good' ability with the proportion of participants with 'no' ability before and after the training workshop. The change in knowledge was evaluated using a Chi- squared

distribution with one degree of freedom at 95% confidence level (i.e., $\alpha = 0.05$). We used the McNemar's χ^2 test for repeat measures.

Results:

A total of 232 training participants out of 282 (82%) responded to the questionnaire. They represented different training sites and industries. There were many positive changes among the trainees after the training. Most people were able to give a correct answers to the questions related to caution zone jobs, the ergonomics rule and how to evaluate jobs. Before the training the proportion of trainees responding correctly to each of the three questions was 50%, 78%, and 32%, respectively. After the training, the proportion responding correctly increased to 74%, 83%, and 45%, respectively. All demonstrated a statistically significant improvement (all $p < 0.05$, Table 1).

We further divided the participants into two groups based on the participants' attendance at previous ergonomic training courses. Some of the trainees had attended 'Ergonomics Rule Overview' ($n=39$), 'Office Ergonomics' ($n=26$), 'Introduction to Ergonomics' ($n=36$), and any 'Other Ergonomics Training' ($n=13$). We evaluated the increase in knowledge of the ergonomics rule requirements among those who attended a previous training compared to those who did not attend the training courses. There was a significant change in post-training knowledge among those with no past training history. The change in knowledge was not significant (small sample size) among participants with past training history in most instances but there was an increase in number of post- training correct responses (Tables 2A-2C). Those with previous ergonomics training had higher scores prior to the workshop than those without previous ergonomics training.

There were a sufficient number of respondents from Agriculture, Forestry and Fishing; Construction; Manufacturing and Service industries to do some descriptive analyses. We noticed an increase in number of participants who gave correct answers to the questions related to a caution zone job, ergonomics rule and how to evaluate jobs (Tables 3A-3B). We could not perform an analytical analysis to assess the statistical significance of this increase due to small number of participants in each cell of 2 X 2 table.

Participants suggested a number of ways to reduce lifting hazards. Not only did the number of valid responses improve but also the quality of the responses were much improved following the training i.e. more engineering controls were identified. This factor was considered while scoring the response of each study participant. The mean score in knowledge greatly and significantly improved ($p < 0.05$). Participants, who did not attend an ergonomics' training workshop in the past, showed a significant improvement in their knowledge score compared to those who had attended an ergonomics' workshop in the past (Table 2D). Participants who attended other workshops also had significant improvement in their ability to identify solutions to lifting hazards. With the different industry sectors, all except agriculture (small numbers)

showed a statistically significant improvement in ability to identify solutions to lifting hazards (Table 3B).

There were significant increases following the workshop in the participants' perceived ability to identify and analyze caution zone jobs ($p < .0001$), to identify and analyze WMSD hazards ($p < 0.001$), to identify requirements for ergonomics awareness education ($p < 0.01$), and to begin introducing ergonomics awareness education into the workplace ($p < 0.0001$) (Table 4). When participants were asked about their ability to identify the requirements for ergonomics awareness education and to begin introducing ergonomics solutions into their workplace, a total of 124 (53%) and 84 (60%) responded having some- to good ability before the training workshop. The response rate changed to 212 (91%) and 217 (94%) to these questions after the training ($p < 0.0001$).

We further evaluated the response by previous training status. Although those with no previous ergonomics training had a greater improvement in their ability to identify and analyze caution zone jobs than those with previous training, all groups had statistically significant improvements (Table 5). A much greater and significant proportion of people with no past training were able to begin identifying and analyzing WMSDs hazards after the training (Table 6). We noted a similar pattern of increase in the proportion of participants who had 'some to good' ability to identify the requirements for ergonomics awareness education and to begin introducing ergonomics solutions into the workplace after the training, irrespective of past training status (Tables 7 & 8). All were statistically significant improvements except for those who had attended the Ergonomics Rule Overview of whom 69% had an ability to introduce ergonomics solutions prior to the 4-hour workshop and 95% had ability after the 4-hour workshop ($p < 0.18$, Table 8).

We also evaluated participants' ability to identify caution-zone jobs, WMSD hazards, and the requirements for ergonomics awareness and workplace solutions by industry sector. Participants from each of the industry sectors benefited from the training (Tables 9A & 9B).

The trainees, as manifested in their consistently positive responses, overwhelmingly appreciated the training workshop. The majority (90%) of the participants rated the workshop as good and excellent. Among those who responded ($n = 165$) to the question about Instructor's preparation, 93% thought it to be very good or exceptional. Among responding participants, 93% rated the Instructor's interaction with participants as very good or exceptional.

Conclusion:

In summary, the Ergonomic Training Workshops have significantly improved the participants' knowledge of ergonomics and the requirements of the Ergonomics rule. This training benefited most the participants without previous ergonomics training. Participants from every industry improved their knowledge about ergonomics. Participants are expected to utilize their enhanced skills to improve the occupational safety and health of their workers, and reduce losses caused by work-related musculoskeletal disorders, thus achieving the long-term objective of the workshop and ergonomics rule.

References:

1. Introductory report of the International Labor Office, International Occupational Safety and Health Information Center, Geneva, International Labor Office, 1999.
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3. Hagberg M, Wegman DH. Prevalence rates and odds ratios of shoulder-neck diseases in different occupational groups. *Br J Ind Med* 1987; 44:602-10.
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Figure 1. Participants in Ergonomic Training Workshop Evaluation(by City)

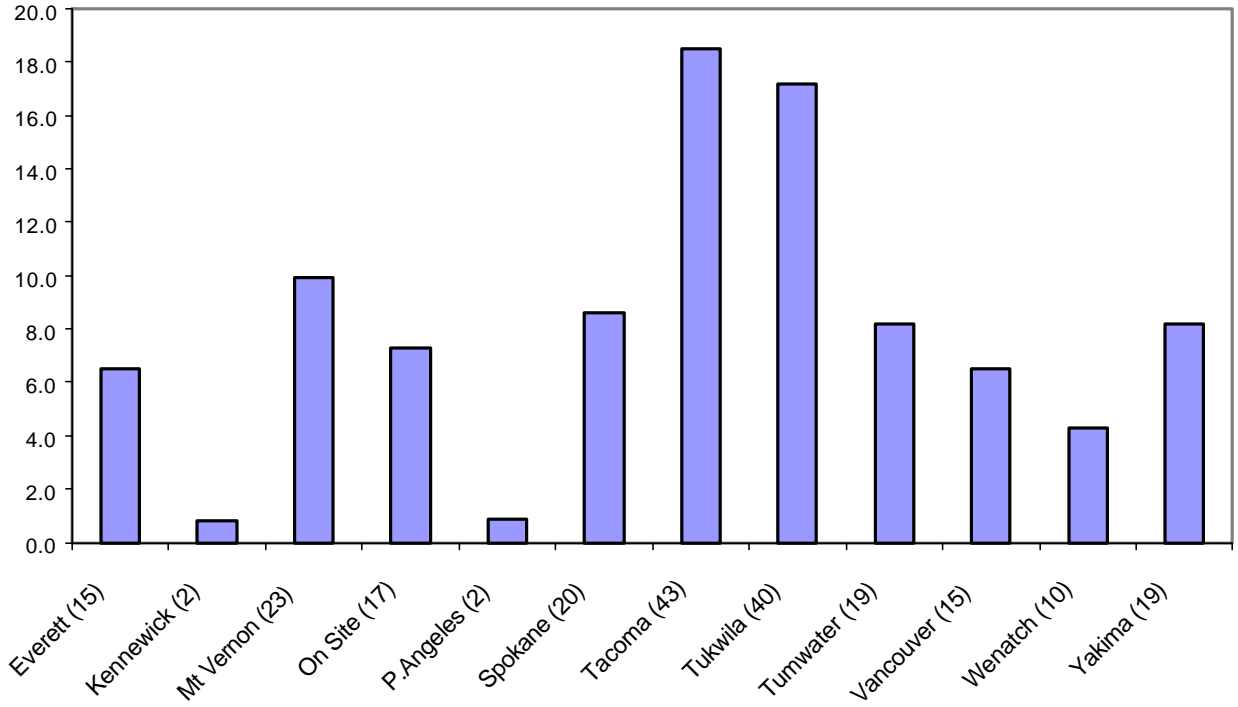
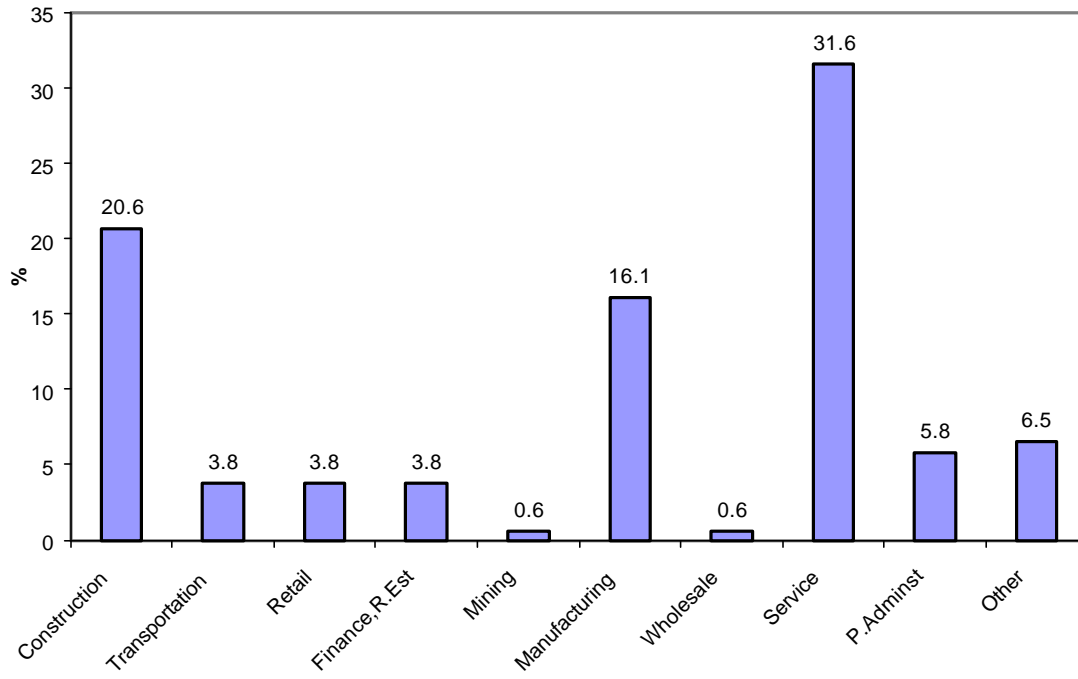


Figure 2. Participants in the Ergonomics Training Workshop Evaluation By Organization



Implementing Ergonomics for Employers Workshop Evaluation Results (Pre and Post Test Scores - N (%))

Pre-1 A caution zone job does not need to be fixed to be in compliance with the rule

1=True	117 (50.4)
2=False	93 (40.1)
9=No answer	22 (09.5)
Total	232 (100.0)

Post-1 A caution zone job does not need to be fixed to be in compliance with the rule

1=True	172 (74.1)
2=False	36 (15.5)
9=No answer	24 (10.4)
Total	232 (100.0)

Pre-2 Under the ergonomics rule, a job is a hazard if an employee reports an injury

1=True	33 (14.2)
2=False	181 (78.0)
9=No answer	18 (07.8)
Total	232 (100.0)

Post-2 Under the ergonomics rule, a job is a hazard if an employee reports an injury

1=True	18 (07.8)
2=False	193 (83.2)
9=No answer	21 (09.0)
Total	232 (100.0)

Pre-3 All jobs must be evaluated using the L&I checklist (Appendix B) of the ergonomics rule.

1=True	135 (58.2)
2=False	75 (32.3)
9=No answer	22 (09.5)
Total	232 (100.0)

Post-3 All jobs must be evaluated using the L&I checklist (Appendix B) of the ergonomics rule.

1=True	104 (44.8)
2=False	104 (44.8)
9=No answer	24 (10.4)
Total	232 (100.0)

Pre-4 List ways you could reduce lifting hazards

1=One or more ways listed	172 (74.1)
9=No answer	60 (25.9)
Total	232 (100.0)

Post-4 List ways you could reduce lifting hazards

1=One or more ways listed	153 (65.9)
9=No answer	79 (34.1)
Total	232 (100.0)

Q1A Rate your ability to begin identifying and analyzing caution zone jobs

1=No ability	25 (10.8)
2	23 (09.9)
3=Some ability	100 (43.1)
4	20 (08.6)
5=Good ability	23 (09.9)
9=No answer	41 (17.7)
Total	232 (100.0)

Q1B Rate your ability to begin identifying and analyzing caution zone jobs

1=No ability	2 (00.9)
2	1 (00.4)
3=Some ability	34 (14.7)
4	75 (32.3)
5=Good ability	107 (46.1)
9=No answer	13 (05.6)
Total	232 (100.0)

Q2A Rate your ability to begin identifying and analyzing WMSD hazards.

1=No ability	44 (18.9)
2	25 (10.8)
3=Some ability	85 (36.6)
4	21 (09.1)
5=Good ability	14 (06.1)
9=No answer	43 (18.5)
Total	232 (100.0)

Q2B Rate your ability to begin identifying and analyzing WMSD hazards.

1=No ability	-
2	2 (0.9)
3=Some ability	38 (16.4)
4	84 (36.2)
5=Good ability	95 (40.9)
9=No answer	13 (05.6)
Total	232 (100.0)

Q3A Rate your ability to identify the requirements for ergonomics awareness education

1=No ability	30 (12.9)
2	36 (15.5)
3=Some ability	80 (34.5)
4	31 (13.4)
5=Good ability	13 (5.6)
9=No answer	42 (18.1)
Total	232 (100.0)

Q3B Rate your ability to identify the requirements for ergonomics awareness education

1=No ability	-
2	5 (2.2)
3=Some ability	29 (12.5)
4	81 (34.9)
5=Good ability	102 (43.9)
9=No answer	15 (6.5)
Total	232 (100.0)

Q4A Rate your ability to begin introducing ergonomics solutions into your workplace.

1-No ability	25 (10.8)
2	26 (11.2)
3=Some ability	88 (37.9)
4	27 (11.6)
5=Good ability	24 (10.3)
9=No answer	42 (18.1)
Total	232 (100.0)

Q4B Rate your ability to begin introducing ergonomics solutions into your workplace.

1-No ability	-
2	2 (00.9)

3=Some ability	45 (19.4)
4	82 (35.5)
5=Good ability	90 (38.8)
9=No answer	13 (05.6)
Total	232 (100.0)

Q5 What is you overall rating of this workshop?

1=Poor	-
2=Fair	2 (00.9)
3=Average	20 (08.6)
4=Good	107 (46.1)
5=Excellent	89 (38.4)
9=No answer	14 (06.0)
Total	232 (100.0)

Q6 How organized and prepared did the instructors appear to be?

1=Not at all	-
2=Slightly	1 (00.4)
3=Somewhat	11 (04.7)
4=Very	98 (42.2)
5=Exceptionally	55 (23.7)
9=No answer	67 (28.9)
Total =	232 (100.0)

Q7 How well did the instructors appear to know the subject?

1=Not at all	-
2=Slightly	-
3=Somewhat	9 (03.9)
4=Very	87 (37.5)
5=Exceptionally	69 (29.7)
9=No answer	67 (28.9)

Q8 How well did the instructors interact with presentation participants?

1=Not at all	-
2=Slightly	1 (0.4)
3=Somewhat	10 (4.3)
4=Very	75 (32.3)
5=Exceptionally	79 (34.5)
9=No answer	67 (28.9)
Total	232 (100.0)

Q9 How easy to use were the handout materials?

1=Not at all	-
2=Slightly	-
3=Somewhat	14 (6.0)
4= Very	108 (46.6)
5=Exceptionally	43 (18.5)
9=No answer	67 (28.9)
Total	232 (100.0)

Q10 What suggestions do you have for improving the workshop?

1=One or more suggestions	35 (15.1)
9=No answer	197 (84.9)
Total	232 (100.0)

Q11 Mark the industry in which you work:

1=Agriculture, forestry, fishing	10 (4.3)
2=Construction	32 (13.8)
3=Transportation/Communication	6 (2.6)
4=Retail	6 (2.6)
5=Finance/Insurance/Real Estate	6 (2.6)
6=Mining	1 (0.4)
7=Manufacturing	25 (10.8)
8=Wholesale	1 (0.4)
9=No Answer	77 (33.2)
10=Service	49 (21.1)
11=Public Administration	9 (3.9)
12= Other	10 (4.3)
Total	232 (100.0)

Q12 Attended Ergonomics Rule Overview Presentation (Start with the Basics)?

1=Yes	39 (16.8)
9= No answer	193 (83.2)
Total	232 (100.0)

Q13 Attended Office Ergonomics?

1=Yes	26 (11.2)
9= No answer	206 (88.8)
Total	232 (100.0)

Q14 Introduction to Ergonomics?

1= Yes	36 (15.5)
9= No answer	196 (84.5)
Total	232 (100.0)

Q15 Attended Other Ergonomics Training?

1=Yes	13 (05.6)
9=No answer	219 (94.4)
Total	232 (100.0)

Q16 How did you learn about this workshop?

1=Received information from L&I in the mail	58 (25.0)
2=Talked with someone who works for L&I	22 (09.5)
3=Business or labor organization provided information	9 (03.9)
4=Co-worker or friend told me about the workshop	19 (08.2)
5=Saw information on L&I's website	36 (15.5)
6=Read or heard about the workshop in the news media	-
7=Other, no explanation	5 (2.2)
8=Other, explanation	1 (0.4)
9=No answer	75 (32.3)
1 and 2	5 (02.2)
2 and 3	2 (0.9)
Total	232 (100.0)

Table 1. Participants' Knowledge of Ergonomics Rules

Statement	Pre-test N (%)	Post-test N (%)	Change (%) 95% CI	McNemar's Chi2	P Value
A caution zone job does not need to be fixed to be in compliance with the rule					
<u>Responses</u>					
Correct	117 (50.4)	172 (74.1)			
In-correct	93 (40.1)	36 (15.5)	28 (19-36)	39.7	0.000
No answer or don't know*	22 (09.5)	24 (10.4)			
A job is a hazard if an employee reports injury					
Correct	181 (78.0)	193 (83.2)			
In-correct	33 (14.2)	18 (07.8)	08 (02-15)	7.8	0.005
No Answer	18 (07.8)	21 (09.0)			
All jobs must be evaluated using the L & I checklist					
Correct	75 (32.3)	104 (44.8)			
In-correct	135 (58.2)	104 (44.8)	14 (06-23)	11.9	0.000
No Answer	22 (09.5)	24 (10.4)			
List ways you could reduce lifting hazards					
	<u>Mean Score (95%CI)</u>		<u>difference (95% CI)</u>		<u>P Value</u>
One or more ways listed	2.52 (2.24-2.79)	3.96 (2.61-3.62)	1.44 (1.16-1.71)		0.000

* Treated as missing variable for the McNemar's chi2 test

Table 2A. Participants' Past Training Status and Knowledge of Ergonomics Rules

S Statement	Pre-test N (%)	Post-test N (%)	Change (%) 95% CI	McNemar's Chi2	P Value	
A caution zone job does not need to be fixed to be in compliance with the rule						
Attended Ergonomics Rule Overview						
Responses						
YES	Correct	25 (64.1)	31 (79.5)			
	In-correct	10 (25.6)	6 (15.4)	12 (-09-33)	1.6	0.205
	No Answer *	4 (10.3)	2 (05.1)			
NO	Correct	92 (47.7)	141 (73.1)			
	In-correct	83 (43.0)	30 (15.5)	31 (22-40)	39.7	0.000
	No Answer	18 (09.3)	22 (11.4)			
Attended Office Ergonomics						
YES	Correct	17 (65.4)	19 (73.1)			
	In-correct	7 (26.9)	4 (15.4)	14 (14-0.-43)	1.3	0.256
	No Answer	2 (07.7)	3 (11.5)			
NO	Correct	100 (48.5)	153 (74.3)			
	In-correct	86 (41.7)	32 (15.5)	29 (20-38)	39.4	0.000
	No Answer	20 (09.8)	21 (10.2)			
Attended Introduction to Ergonomics						
YES	Correct	20 (55.6)	26 (72.2)			
	In-correct	11 (30.6)	7 (19.5)	14 (10--39)	1.6	0.205
	No Answer	5 (13.8)	3 (08.3)			
NO	Correct	97 (49.5)	146 (74.5)			
	In-correct	82 (41.8)	29 (14.8)	29 (02-38)	39.4	0.000
	No Answer	17 (08.7)	21 (10.7)			
Attended Other Ergonomics Training						
YES	Correct	10 (76.9)	11 (84.6)			
	In-correct	3 (23.1)	1 (07.7)			
	No Answer	-	1 (07.7)			
NO	Correct	107 (48.8)	161 (73.5)			
	In-correct	90 (41.1)	35 (15.9)	28 (20-37)	37.8	0.000
	No Answer	22 (10.1)	23 (10.6)			
* A response of "no answer" or "don't know" to the question about caution zone job was treated as a missing variable for McNemar's χ^2 test						

Table 2B. Participants' Past Training Status and Knowledge of Ergonomics Rules

Statement	Pre-test N (%)	Post-test N (%)	difference (%) 95% CI	McNemar's Chi2	P Value	
A job is a hazard if an employee reports injury						
Attended Ergonomics Rule Overview						
Responses						
YES	Correct	34 (87.2)	34 (87.2)	02 (-11-43)	2.0	0.154
	In-correct	2 (05.1)	3 (07.7)			
	No Answer	3 (07.7)	2 (05.1)			
NO	Correct	147 (76.2)	159 (82.4)	11 (18-37)	9.5	0.002
	In-correct	31 (16.1)	15 (07.8)			
	No Answer	15 (07.7)	19 (09.8)			
Attended Office Ergonomics						
YES	Correct	22 (84.6)	23 (88.5)	04 (-08-17)	1.0	0.317
	In-correct	1 (07.7)	1 (03.8)			
	No Answer	2 (07.7)	2 (07.7)			
NO	Correct	159 (77.2)	170 (82.5)	09 (02-16)	7.1	0.007
	In-correct	31 (15.1)	17 (08.3)			
	No Answer	16 (07.7)	19 (09.2)			
Attended Introduction to Ergonomics						
YES	Correct	28 (77.8)	29 (80.6)	06 (-05-18)	2.0	0.157
	In-correct	6 (16.7)	4 (11.1)			
	No Answer	2 (05.5)	3 (8.3)			
NO	Correct	153 (78.1)	164 (83.7)	09 (02-17)	6.4	0.011
	In-correct	27 (13.8)	14 (07.1)			
	No Answer	16 (08.1)	18 (09.2)			
Attended Other Ergonomics Training						
YES	Correct	10 (76.9)	11 (84.6)	16 (-12-46)	0.3	0.157
	In-correct	3 (23.1)	1 (07.7)			
	No Answer	-	1 (07.7)			
NO	Correct	171 (78.1)	182 (83.1)	08 (01-15)	6.4	0.012
	Incorrect	30 (13.7)	17 (07.8)			
	No Answer	18 (08.2)	20 (09.1)			

* A response of "no answer" or "don't know" to the question was treated as a missing variable for the McNemar' χ^2 test

Table 2C. Participants' Past Training Status and Knowledge of Ergonomics Rules

Statement	Pre-test N (%)	Post-test N (%)	difference (%) 95% CI	McNemar's Chi2	P Value
All jobs must be evaluated using the L & I checklist					
Attended Ergonomics Rule Overview					
Responses					
YES	Correct	18 (46.1)	22 (56.4)		
	In-correct	18 (46.1)	15 (38.5)	09 (-11-28)	1.0 0.317
	No Answer	3 (07.8)	2 (05.1)		
NO	Correct	57 (29.5)	82 (42.5)		
	In-correct	117 (60.6)	89 (46.1)	15 (06-25)	11.1 0.000
	No Answer	19 (09.9)	22 (11.4)		
Attended Office Ergonomics					
YES	Correct	12 (46.1)	16 (61.5)		
	In-correct	11 (42.3)	08 (30.8)	14 (-05-34)	3.0 0.083
	No Answer	3 (11.6)	02 (07.7)		
NO	Correct	64 (31.1)	88 (42.7)		
	In-correct	123 (59.7)	96 (46.6)	14 (05-23)	9.9 001
	No Answer	19 (09.2)	22 (10.7)		
Attended Introduction to Ergonomics					
YES	Correct	14 (38.9)	17 (47.2)		
	In-correct	18 (50.0)	15 (41.7)	10 (-13-34)	1.0 0.317
	No Answer	4 (11.1)	4 (11.1)		
NO	Correct	61 (31.1)	87 (44.4)		
	In-correct	117 (59.7)	89 (45.4)	15 (06-24)	11.1 0.000
	No Answer	18 (09.2)	20 (10.2)		
Attended Other Ergonomics Training					
YES	Correct	4 (30.8)	3 (23.1)		
	In-correct	9 (69.2)	9 (69.2)	14 (-25-54)	1.0 0.317
NO	No Answer	-	1 (07.7)		
	Correct	71 (32.4)	101 (46.1)		
	In-correct	126 (57.5)	95 (43.4)	15 (06-24)	12.4 0.000
	No Answer	22 (10.1)	23 (10.5)		

* A response of "no answer" or "don't know" to the question was treated as a missing variable for the McNemar's χ^2 test

Table 2D. Participants' Past Training Status and Knowledge of Ergonomics Rules

Statement	Pre-test Mean score (95%CI)	Post-test Mean score (95%CI)	difference	P Value
List ways you could reduce lifting hazards				
Attended Ergonomics Rule Overview				
YES				
One or more ways listed	2.97 (2.40-3.55)	4.56 (3.65-5.47)	1.58 (0.79-2.39)	0.001
NO				
One or more ways listed	2.42 (2.11-2.73)	3.83 (3.47-4.19)	1.41 (1.69-2.00)	0.000
Attended Office Ergonomics				
YES				
One or more ways listed	2.80 (1.98-3.71)	3.61 (2.69-4.54)	0.76 (0.37-1.17)	0.001
NO				
One or more ways listed	2.47 (2.18-2.77)	4.18 (3.63-4.36)	1.52 (1.22-1.82)	0.000
Attended Introduction to Ergonomics				
YES				
One or more ways listed	2.75 (2.15-3.34)	3.97 (2.85-5.08)	1.22 (0.40-2.04)	0.004
NO				
One or more ways listed	2.47 (2.17-2.78)	3.95 (3.60-4.30)	1.48 (1.76-2.02)	0.000
Attended Other Ergonomics Training				
YES				
One or more ways listed	3.77 (2.69-4.85)	4.92 (4.25-5.59)	1.15 (0.05-2.35)	0.058
NO				
One or more ways listed	2.44 (2.16-2.72)	3.89 (3.54-4.25)	1.46 (1.17-1.73)	0.000

Table 3A. Participants' Knowledge of Ergonomics Rules By Organization

Statement	Pre-test N (%)	Post-test N (%)
A caution zone job does not need to be fixed to be in compliance with the rule		
<u>AGRICULTURE, FORESTRY AND FISHING</u>		
<u>RESPONSES</u>		
Correct	2 (25.0)	6 (60.0)
In-correct	6 (75.0)	4 (40.0)
<u>CONSTRUCTION</u>		
Correct	14 (45.2)	18 (66.3)
In-correct	17 (54.8)	9 (33.7)
<u>MANUFACTURING</u>		
Correct	15 (65.2)	20 (95.2)
In-correct	8 (34.8)	1 (04.8)
<u>SERVICE</u>		
Correct	22 (55.0)	44 (89.8)
In-correct	18 (45.0)	5 (10.2)
A job is a hazard if an employee reports injury		
<u>AGRICULTURE, FORESTRY AND FISHING</u>		
Correct	5 (62.5)	10 (100.0)
In-correct	3 (37.5)	-
<u>CONSTRUCTION</u>		
Correct	20 (83.3)	19 (95.0)
In-correct	4 (16.7)	1 (07.1)
<u>MANUFACTURING</u>		
Correct	10 (83.3)	12 (95.0)
In-correct	2 (16.7)	1 (05.0)
<u>SERVICE</u>		
Correct	34 (85.0)	46 (93.9)
In-correct	6 (16.0)	2 (06.1)

Table 3B. Participants' Knowledge of Ergonomics Rules By Organization

Statement	Pre-test N (%)	Post-test N (%)
All jobs must be evaluated using the L & I checklist		
<u>AGRICULTURE, FORESTRY AND FISHING</u>		
RESPONSE		
Correct	4 (50.0)	8 (80.0)
In-correct	4 (50.0)	2 (20.0)
<u>CONSTRUCTION</u>		
Correct	14 (45.2)	15 (57.7)
In-correct	17 (54.8)	11 (42.3)
<u>MANUFACTURING</u>		
Correct	10 (41.7)	7 (35.0)
In-correct	14 (58.3)	13 (65.0)
<u>SERVICE</u>		
Correct	10 (25.0)	18 (36.7)
In-correct	30 (75.0)	31 (63.3)
List ways you could reduce lifting hazards		
	Mean score (95%CI)	difference (95%CI) P
Value		
<u>AGRICULTURE, FORESTRY AND FISHING</u>		
One or more ways listed	2.2 (0.36—4.04)	3.1 (1.06-5.14) 0.9 (0.38-2.18) 0.146
<u>CONSTRUCTION</u>		
One or more ways listed	2.84 (2.84-3.54)	3.78 (2.94-4.62) 0.93 (1.55-1.70) 0.003
<u>MANUFACTURING</u>		
One or more ways listed	3.12 (2.37-3.87)	4.56 (3.46-5.66) 1.44 (0.46-2.41) 0.005
<u>SERVICE</u>		
One or more ways listed	1.79 (1.25-2.34)	3.47 (2.87-4.07) 1.67 (2.29-2.15) 0.000

Table 4. Pre and Post Training Scores by Ergonomics Training Workshop Participants.

	Pre-test N (%)	Post-test N (%)	difference (%) 95% CI	McNemar's Chi2	P Value
1) Ability to begin identifying and analyzing caution-zone jobs					
No ability	89 (38.4)	16 (06.9)			
Some- to good ability	143 (61.6)	216 (93.1)	27 (19-36)	39.7	0.000
2) Ability to begin identifying and analyzing WMSD hazards					
No ability	112 (48.3)	15 (06.5)			
Some- to good ability	120 (51.7)	217 (93.5)	09 (02-15)	07.8	0.005
3) Ability to identify the requirements for ergonomics awareness education					
No ability	108 (46.6)	20 (08.6)			
Some- to good ability	124 (53.4)	212 (91.4)	14 (06-23)	11.9	0.000
4) Ability to begin introducing ergonomics solution into the workplace					
No ability	93 (40.1)	15 (06.5)			
Some- to good ability	84 (59.9)	217 (93.5)	37 (27-47)	42.4	0.000

Table 5. Participants' Past Training Status and the Ability to Begin Identifying and Analyzing Caution-zone Jobs

Statement	Pre-test N (%)	Post-test N (%)	difference (%) 95% CI	McNemar's Chi2	P Value
Attended Ergonomics Rule Overview					
<u>YES</u>					
No ability	12 (30.7)	2 (05.1)			
Some- to good ability	27 (69.3)	37 (94.9)	25 (07-44)	8.3	0.004
<u>NO</u>					
No ability	77 (39.9)	14 (07.3)			
Some-to good ability	116 (60.1)	179 (92.7)	32 (24-41)	33.9	0.000
Attended Office Ergonomics					
<u>YES</u>					
No ability	7 (26.9)	1 (03.8)			
Some- to good ability	19 (73.1)	25 (96.2)	23 (03-43)	6.0	0.014
<u>NO</u>					
No ability	82 (39.8)	15 (07.3)			
Some- to good ability	124 (60.2)	191 (92.7)	33 (24-41)	48.3	0.000
Attended Introduction to Ergonomics					
<u>YES</u>					
No ability	13 (36.1)	3 (08.3)			
Some- to good ability	23 (63.9)	33 (91.7)	27 (07-48)	7.1	0.012
<u>NO</u>					
No ability	76 (38.7)	13 (06.6)			
Some- to good ability	120 (61.3)	183 (93.4)	32 (24-41)	46.7	0.000
Attended Other Ergonomics Training					
<u>YES</u>					
No ability	2 (15.4)	-			
Some- to good ability	11 (84.6)	13 (100.0)			
<u>NO</u>					
No ability	87 (39.7)	16 (07.3)			
Some- to good ability	132 (60.3)	203 (92.7)	32 (24-40)	51.9	0.000

Table 6. Participants' Past Training Status and the Ability to Begin Identifying and Analyzing WMSD hazards

Statement	Pre-test N (%)	Post-test N (%)	difference (%) 95% CI	McNemar's Chi2	P Value
Attended Ergonomics Rule Overview					
<u>YES</u>					
No ability	15 (38.5)	2 (05.1)			
Some- to good ability	24 (61.5)	37 (94.9)	33 (14-52)	11.3	0.000
<u>NO</u>					
No ability	97 (50.3)	13 (06.7)			
Some-to good ability	96 (49.7)	180 (93.3)	44 (34-52)	71.4	0.000
Attended Office Ergonomics					
<u>YES</u>					
No ability	9 (34.6)	1 (03.8)			
Some- to good ability	17 (65.4)	25 (96.2)	30 (09-52)	8.0	0.004
<u>NO</u>					
No ability	103 (50.0)	14 (06.8)			
Some- to good ability	103 (50.0)	192 (93.2)	43 (34-52)	71.4	0.000
Attended Introduction to Ergonomics					
<u>YES</u>					
No ability	18 (50.0)	3 (08.3)			
Some- to good ability	18 (50.0)	33 (91.7)	42 (19-64)	11.8	0.000
<u>NO</u>					
No ability	94 (47.9)	12 (06.1)			
Some- to good ability	102 (52.1)	184 (93.9)	42 (33-50)	67.2	0.000
Attended Other Ergonomics Training					
<u>YES</u>					
No ability	3 (23.1)	-			
Some- to good ability	10 (76.9)	13 (100.0)	23 (07-54)	3.0	0.083
<u>NO</u>					
No ability	109 (49.8)	15 (06.8)			
Some- to good ability	110 (50.2)	204 (93.2)	43 (35-51)	76.2	0.000

Table 7. Participants' Past Training Status and the Ability to Identify the Requirements for Ergonomics Awareness Education

Statement	Pre-test N (%)	Post-test N (%)	difference (%) 95% CI	McNemar's Chi2	P value
Attended Ergonomics Rule Overview					
<u>YES</u>					
No ability	14 (35.9)	3 (07.7)			
Some- to good ability	25 (64.1)	36 (92.3)	28 (08-48)	8.7	0.004
<u>NO</u>					
No ability	94 (48.7)	17 (08.8)			
Some-to good ability	99 (51.3)	176 (91.2)	39 (31-49)	61.1	0.000
Attended Office Ergonomics					
<u>YES</u>					
No ability	8 (30.8)	1 (03.8)			
Some- to good ability	18 (69.2)	25 (96.2)	26 (06-48)	7.0	0.008
<u>NO</u>					
No ability	100 (48.5)	19 (09.2)			
Some- to good ability	106 (51.5)	187 (90.8)	39 (31-48)	62.5	0.000
Attended Introduction to Ergonomics					
<u>YES</u>					
No ability	18 (50.0)	3 (08.3)			
Some- to good ability	18 (50.0)	33 (91.7)	42 (19-64)	11.8	0.000
<u>NO</u>					
No ability	90 (45.9)	17 (08.7)			
Some- to good ability	106 (54.1)	179 (91.3)	37 (28-46)	57.3	0.000
Attended Other Ergonomics Training					
<u>YES</u>					
No ability	5 (38.5)	-			
Some- to good ability	8 (61.5)	13 (100.0)	38 (04-72)	5.0	0.025
<u>NO</u>					
No ability	103 (47.0)	20 (09.1)			
Some- to good ability	116 (53.0)	199 (90.9)	37 (29-46)	64.4	0.000

Table 8. Participants' Past Training Status and the Ability to Begin Introducing Ergonomics Solution into the Workplace

Statement	Pre-test N (%)	Post-test N (%)	difference (%) 95% CI	McNemar's Chi2	P Value
Attended Ergonomics Rule Overview					
<u>YES</u>					
No ability	12 (30.8)	2 (05.1)			
Some- to good ability	27 (69.2)	37 (94.9)	25 (07-44)	8.3	0.179
<u>NO</u>					
No ability	81 (41.9)	13 (06.7)			
Some-to good ability	112 (58.9)	180 (93.3)	35 (28-44)	52.6	0.000
Attended Office Ergonomics					
<u>YES</u>					
No ability	06 (23.1)	1 (03.8)			
Some- to good ability	20 (76.9)	25 (96.2)	19 (01-38)	5.0	0.025
<u>NO</u>					
No ability	87 (42.2)	14 (06.8)			
Some- to good ability	119 (57.8)	192 (93.2)	35 (26-44)	52.7	0.000
Attended Introduction to Ergonomics					
<u>YES</u>					
No ability	15 (41.7)	3 (08.3)			
Some- to good ability	21 (58.3)	33 (91.7)	33 (11-55)	9.0	0.002
<u>NO</u>					
No ability	78 (39.8)	12 (06.1)			
Some- to good ability	118 (60.2)	184 (93.9)	35 (27-44)	52.6	0.000
Attended Other Ergonomics Training					
<u>YES</u>					
No ability	4 (30.8)	-			
Some- to good ability	9 (69.2)	13 (100.0)	30 (02-63)	4.0	0.045
<u>NO</u>					
No ability	89 (40.6)	15 (06.8)			
Some- to good ability	130 (59.4)	204 (93.2)	33 (26-42)	57.0	0.000

Table 9A. Participants' ability to identify caution zone-jobs, WMSD Hazards, Requirements for Ergonomics Awareness Education and Workplace Solution by Organization

Statement	Pre-test N (%)	Post-test N (%)
Ability to begin identifying and analyzing caution-zone jobs		
<u>AGRICULTURE, FORESTRY AND FISHING</u>		
No ability	3 (30.0)	-
Some- to good ability	7 (70.0)	10 (100.0)
<u>CONSTRUCTION</u>		
No ability	12 (37.5)	4 (12.5)
Some- to good ability	20 (62.5)	28 (87.5)
<u>MANUFACTURING</u>		
No ability	7 (28.0)	2 (08.0)
Some- to good ability	18 (72.0)	23 (92.0)
<u>SERVICE</u>		
No ability	30 (61.2)	1 (03.3)
Some- to good ability	19 (38.8)	29 (96.7)
Ability to begin identifying and analyzing WMSD hazards		
<u>AGRICULTURE, FORESTRY AND FISHING</u>		
No ability	4 (40.0)	-
Some- to good ability	6 (60.0)	10 (100.0)
<u>CONSTRUCTION</u>		
No ability	17 (53.1)	4 (12.5)
Some- to good ability	15 (46.9)	28 (87.5)
<u>MANUFACTURING</u>		
No ability	15 (60.0)	1 (04.0)
Some- to good ability	10 (40.0)	24 (96.0)
<u>SERVICE</u>		
No ability	14 (28.6)	1 (02.1)
Some- to good ability	35 (71.4)	48 (97.9)

Table 9B. Participants' Ability to Identify Caution Zone Jobs, WMSD Hazards, Requirements for Ergonomics Awareness Education and Workplace Solutions by Organization

Statement	Pre-test N (%)	Post-test N (%)
Ability to identify the requirements for ergonomics awareness education		
<u>AGRICULTURE, FORESTRY AND FISHING</u>		
No ability	6 (60.0)	-
Some- to good ability	4 (40.0)	10 (100.0)
<u>CONSTRUCTION</u>		
No ability	20 (62.5)	5 (15.6)
Some- to good ability	12 (37.5)	27 (84.4)
<u>MANUFACTURING</u>		
No ability	14 (56.0)	2 (08.0)
Some- to good ability	11 (44.0)	23 (92.0)
<u>SERVICE</u>		
No ability	19 (38.8)	2 (04.1)
Some- to good ability	30 (61.2)	47 (95.9)
Ability to begin introducing ergonomics solution into the workplace		
<u>AGRICULTURE, FORESTRY AND FISHING</u>		
No ability	3 (40.0)	-
Some- to good ability	7 (60.0)	10 (100.0)
<u>CONSTRUCTION</u>		
No ability	11 (34.42)	4 (12.5)
Some- to good ability	21 (65.6)	28 (87.5)
<u>MANUFACTURING</u>		
No ability	06 (24.0)	2 (08.0)
Some- to good ability	19 (76.0)	23 (92.0)
<u>SERVICE</u>		
No ability	16 (32.6)	-
Some- to good ability	33 (67.4)	49 (100.0)